PORTLAND HARBOR RI/FS

ROUND 3A UPLAND STORMWATER SAMPLING FIELD SAMPLING REPORT

DO NOT QUOTE OR CITE
This document is currently under review by U.S. EPA and its federal, state and tribal partners, and is subject to change in whole or in part.

RECOMMENDED FOR INCLUSION IN ADMINISTRATIVE RECORD

November 30, 2007

Prepared for:
The Lower Willamette Group

Prepared by:
Anchor Environmental, L.L.C.

Integral Consulting, Inc.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS

CAS	Columbia Analytical Service
CN	Curve Number
DEQ	Oregon Department of Environmental Quality
DO	Dissolved Oxygen
DOC	dissolved organic carbon
EMC	Event Mean Concentration
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
FSR	Field Sampling Report
HDPE	High density polyethylene
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
ORP	oxidation/redox potential
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI/FS	remedial investigation/feasibility study
SBUH	Santa Barbara Unit Hydrograph
SCS	Soil Conservation Service
SOP	standard operating procedure
SSR	Stormwater Sampling Rationale
TOC	total organic carbon
USGS	United States Geological Service

1.0 Introduction

This Field Sampling Report (FSR) summarizes the upland stormwater field sampling activities conducted from February through July 2007 for the Remedial Investigation and Feasibility Study (RI/FS) of the Portland Harbor Superfund Site (Site). The planned sampling activities are described in detail in the Round 3A Stormwater Sampling – Field Sampling Plan (FSP) (Anchor and Integral 2007a) and the Round 2 Quality Assurance Project Plan Addendum 8 (Integral 2007). This FSR and the FSP and QAPP are companion documents to the Round 3A Stormwater Sampling Rationale (SSR) (Anchor and Integral 2007b; Appendix AA), which describes the reasoning behind the overall sampling approach. This FSR cites sections of the FSP instead of repeating sampling method details here.

This FSR includes information on the field methods and sampling procedures as implemented for the project, but does not include the analytical results of any of the samples collected. It also does not include field-collected analytical data such as pH, temperature, etc. All analytical data will be presented and discussed in the Stormwater Site Characterization Summary Report to be published at a later date.

The contents of the FSP and SSR were written by the Stormwater Technical Team for the project, comprised of Oregon Department of Environmental Quality (DEQ), U.S. Environmental Protection Agency (EPA), and Lower Willamette Group (LWG) member representatives. Although the SSR was never submitted formally to EPA for official review, comment, and approval, it was intent of the Stormwater Technical Team (which includes EPA) that the SSR serve as a record of the rationale for the sampling methods described in the FSP. During the course of sampling activities, the Stormwater Technical Team, with EPA approval, provided additional instructions on sampling and analysis procedures that were documented in meeting highlight emails (Appendix Y-Technical Team Emails Documenting Changes). These additional instructions are noted in this document.

Sampling at seven stations near Terminal 4 and at the GE Decommissioning Facility is also described in the FSP. As agreed to by the Stormwater Technical Team, because this sampling was conducted by other entities, field sampling procedures for these locations are not reported here. The field and analytical data from these stations will be provided in the future for data analysis and stormwater loading estimates and will be discussed in the Stormwater Site Characterization Summary Report. Sampling at these eight stations is briefly summarized in Section 2.0.

1.1 OBJECTIVES OF ROUND 3A UPLAND STORMWATER SAMPLING

The objectives of the Round 3A upland stormwater sampling program are to provide data for evaluating the potential risk related to in-river fish tissue chemical burdens and sediment recontamination from stormwater discharges to the river. These data will be

used for understanding the relative magnitude of stormwater impacts to the harbor, developing the draft Site RI, identifying remaining stormwater data gaps, and eventually evaluating remedial alternatives in the Site FS (see SSR for details).

1.2 DOCUMENT ORGANIZATION

The remaining sections of this document describe the sampling field and analytical procedures that were used to collect stormwater and sediment samples:

- Section 2 provides an overview of the field sampling approach.
- Section 3 provides a chronology of the field sampling operations.
- Section 4 provides a summary of the stormwater composite sample field sampling procedures.
- Section 5 provides a summary of the stormwater grab sample field sampling procedures.
- Section 6 provides a summary of the sediment field sampling procedures.
- Section 7 provides a summary of the laboratory analyses.
- Section 8 provides references.

Appendices A through W are Site-Specific Sampling Reports, each dedicated to a single sampling location. Each report contains sampling and equipment specifics for that location. Appendix X contains the field chain of custody forms and compositing instructions. Appendix Y contains emails describing Stormwater Technical Team decisions subsequent to the FSP regarding sampling and analysis procedures. Appendix Z contains data output from the Flowlink database from the ISCO samplers. Appendix AA contains the Round 3A SSR (Anchor and Integral 2007b).

2.0 Overview of Field Sampling Approach

The objectives of the sampling are briefly described in Section 1.1 and detailed in the SSR. The FSP describes the approach for measuring the chemical concentrations in stormwater and for obtaining stormwater flow data at 31 upland locations around the Site to meet those objectives (Figure 2-1a-c)[1].

Note that as discussed in Section 1.0, Figure 2-1 shows eight additional stations discussed in the FSP but not included in this FSR. Seven stations in the vicinity of Terminal 4 were sampled by the Port of Portland and are not discussed further in this document. Field sampling procedures for sampling at Terminal 4 is described in the following documents: Appendix N – Terminal 4 Recontamination Analysis (BBL 2006), Stormwater Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities (Ashcreek/Newfields June 2007), and Modifications to Storm Water Sampling Program/Recontamination Analysis for Fall 2007 Program (Ash Creek 2007). The Port volunteered to add their stations to the sampling program in order to make it more robust on the condition that they would conduct the sampling. Additionally, during the project initiation, the Stormwater Technical Team recommended and EPA agreed that one site (GE Decommissioning draining to OF-17) would be sampled by the site owner instead of LWG. The rationale for this is documented Table 4-4 and Appendix Y. Field sampling procedures for the GE Decommissioning Facility are contained in the Storm Water Monitoring Report GE Energy - Energy Services (AMEC 2007). GE was preparing to collect stormwater samples as part of the DEQ Cleanup program stormwater pathway evaluation. The work plan did not include sediment traps, but GE agreed to collect sediment in a site catch basin, if available.

Consequently, the total number of stations described in this document is 23. While the sampling at the other eight stations at Terminal 4 and GE was not conducted by the LWG, the data from these stations will be essential to meeting project objectives during the data analysis.

In other cases, some alternate locations to those identified in the FSP were recommended for sampling by the Stormwater Technical Team with EPA approval. Appendix Y contains emails describing these station changes. The actual sampling locations utilized per these changes and sampled by the LWG are shown in Figure 2-2 (a-c). The sampling stations that changed from the FSP include WR-123, WR-384, WR-142. The rationale for these changes is detailed in Appendix Y (and in field deviation section below). In summary, the changes were:

- Schnitzer International Slip - The FSP indicated that WR-121 or WR-123 would be sampled because the actual location had not

[1] Note that the drainage basins shown in these figures from the FSP are only approximate and are not intended to portray exact delineations of any stormwater basins, but only the relative general size and shape of each basin.

been selected at that time. WR-123 was selected by the Stormwater Technical Team.

- Schnitzer Riverside - The FSP indicated that WR-108 would be sampled. Reconnaissance of the site resulted in the Stormwater Technical Team changing the location to WR-384.
- Gunderson - The FSP indicated sampling at WR-145, which was sampled up to May 1, 2007. Due to a barge being placed over the outfall, the location was changed to WR-142 on May 1, 2007 per agreement with the Stormwater Technical Team.
- Sulzer – The FSP indicated that WR-4 would be sampled. However, during preparation of this FSR, it was discovered that a different outfall was sampled. Because sample identification sent to the lab refers to WR-4 and it is unclear from currently available information exactly what the designation of the sampled outfall should be, this FSR refers to this station as WR-4*. Additional reconnaissance and information gathering on this site is being conducted to establish the most appropriate final designation for WR-4* and determine its drainage area.

The FSP Standard Operating Procedures (SOPs) describe the sampling procedures in detail. In summary, the planned sampling approach described by the FSP includes:

1. Flow-weighted composite stormwater samples using automated Teledyne ISCO (ISCO) samplers from three storm events including whole water for organic compound analyses and filtered/unfiltered pairs for metals analyses.
2. One additional set of grab stormwater samples at 10 of the 23 planned sampling locations for sampling of filtered/unfiltered pairs and analysis of selected organic compounds and associated conventionals.
3. Sediment trap deployment (to collect suspended sediment from stormwater and analyze for sediment chemistry) for a minimum duration of 3 months.
4. Continuous flow monitoring at each sampling site for the duration of the sampling effort, to facilitate flow-based stormwater composite sampling.

In some cases, not all these data points were actually collected due to logistical, weather, and other issues, and these cases are described in Section 3.3.

3.0 Chronology of Field Operations

This section summarizes the chronology of the field sampling operations, from initial installation of the equipment, sampling activities, and final removal of the equipment. In general, all procedures described followed the FSP unless otherwise noted. Deviations from the FSP are discussed for each sampling type in Sections 4, 5, and 6, respectively.

3.1 MOBILIZATION AND INITIAL PROGRAMMING

Mobilization for the field sampling program began in January 2007. Based on the draft FSP, LWG authorized purchase of the sampling equipment. On January 15, an initial order for the automated sampling equipment was made with ISCO for 24 automated samplers (Model 6712). Each sampler set up included an area velocity flow meter (Model 750) and a cellular phone modem, as well as Teflon lined sample collection tube and four sets of sampling jars.

Also beginning in mid-January, reconnaissance teams began contacting LWG members and non-members (once permission was given) regarding access to their sites and any special requirements that needed to be met to facilitate sampling. Some sites required special safety training, confined space training, traffic management plans, escorted access, and/or restricted access times. The specific requirements for each site are contained in the field reconnaissance reports in their respective appendices (Appendix A-W) to this document.

Preliminary site reconnaissance visits and review of stormwater system information was conducted while any site-specific training and access agreements were obtained and site-specific sampling procedures were developed. These preliminary visits were made to characterize the drainage basins and outfall locations to allow fabrication or ordering of equipment that would be needed to mount the automated water samplers and sediment traps at each site. The specific mounting hardware for each site is shown on a figure and in photographs in their respective appendices (Figures 2 and 3, Appendix A-W) to this document. Drainage basin characteristics such as size and percent impervious area were collected for use in estimating flow volumes for sampler programming, and are included in Appendix A-W.

The ISCO samplers arrived at the LWG Field Laboratory on February 23, 2007. The samplers were unpacked and plugged into power supplies to ensure their proper function. The following week the ISCO samplers were decontaminated, sample jars sent to the analytical laboratory for decontamination, and initial programming was completed.

The initial programming consisted of entering site identification, alarm dial out numbers, data collection frequency, and a series of programs to cover the range of potential runoff volumes at each site in response to a precipitation event. The specific

programming strategies are described in Section 4 of this FSR. As the samplers were installed, additional entries were made to the programs. These entries included the measured pipe diameter, the offset of the flow meter (if not installed in the bottom of the pipe), and the length of the sample pickup tube. Additionally, the water depth measured by the sampler was verified and adjusted if needed. The entries critical to sample collection details for each site are included in Appendix A-W.

3.2 INSTALLATION OF SEDIMENT TRAPS AND ISCO SAMPLERS

Due to a range of logistical issues, such as obtaining access agreements and fabricating installation equipment, the dates of ISCO sampler and sediment trap samplers ranged from January 30, 2007 to April 20, 2007. The installation dates for ISCO samplers and sediment traps are summarized in Table 3-1.

During installation, the preliminary programming was completed for each sampler as noted above. The installation details for each site are included in their respective appendices to this document. These appendices include diagrams of the installation, photographs of the installation, and the programming information.

3.3 STORM EVENT SUMMARY

This section contains a summary of the response to each storm event sampled. Note that the "sample date" is the date the whole water samples were retrieved from the field and the sample was prepared from the aliquots collected by the ISCO automated samplers. These are the dates that this report references when discussing particular samples and the dates referenced by the lab for each sample. Dates of rainfall and automated sample collection are summarized by storm sample date in Tables 3-3(a-i) Generally, the sampling activities, such as activating the ISCO automated samplers, began several days before the samples were prepared.

The storm conditions targeted for sampling as described in the FSP were to meet both of the following criteria:

- Storms predicted to produce more than 0.2 inches of rainfall over a minimum of a 3-hour period, not to exceed approximately 2.25 inches in a 24-hour period (equivalent to the 2-year event)
- Storms preceded by at least a 24-hour dry period (less than 0.1 inches rainfall).

The storms sampled, as discussed below, had average rainfall amounts ranging between 0.26 and 1.12 inches, had average durations between 0.17 days to 1.42 days, and had antecedent dry periods of a minimum of 24 hours and a maximum of almost ten days. As discussed in Section 4.4, the precipitation was found to be variable in the Portland

metropolitan area, with the project site frequently in the rain shadow of the Tualatin Mountains, so different rain gages were used for each site based on vicinity.

Table 3-2 provides a summary of samplers successfully collecting samples for each storm event. The table identifies a successful event by identifying the type of sampling program activated. The table also shows which samplers were installed for a particular event, and if no samples were collected because adequate samples had already been collected from the site. The general approach was to attempt to collect samples at as many installed stations as possible. As samples were successfully collected, some prioritization of collection occurred to attempt to obtain samples at those stations where samples were not obtained in previous storms.

The following subsections summarize sampling for each storm event. The preparation of the laboratory samples for specific water quality analyses by site and storm is further described in Section 4.5.

3.3.1 Response to Storm 1: Sample Date – March 26, 2007

On the evening of March 23, 2007, 17 of the 19 ISCO automated samplers installed by that time were activated via cell phone modem in anticipation of a storm that was forecasted to deliver between 0.75 and 1.50 inches of rain beginning early March 24. These 17 are referred to as the activated samplers in this section. (Samplers at HWY 30, WR-218, WR-384, and WR-123 were not installed at this time due to site access issues.) Detailed programming information is shown in the Site-Specific Sampling Reports in Appendices A to W. A flow-based program was activated for 14 of the samplers. Because of difficulties measuring velocity, and consequently flow, preceding the storm event, samplers at three stations were programmed to sample on a time-based approach.[2] These samplers, once triggered by increased level (and thus flow), collected samples at 20-minute intervals until the sample bottles were full. These time-based samples were manually composited in the field lab as discussed in Section 4-4. Figure 3-1 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 1.

The first measurable rainfall was recorded on March 24 at 4:00 a.m. and had two discrete peaks. Depending on the rain gage, the total rainfall for the storm ranged between 0.94 and 1.24 inches and lasted just over 24 hours. The antecedent dry period was approximately 3½ days, with 0.05 inches of rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3a. Note that for one sample location, WR-4*, the first part of the storm with 0.37 inches of rain was sampled only. This was due to the fact that the runoff for this site was underestimated, so all bottles were filled after the first hydrograph peak. However, this smaller duration

[2] The differences between time-based and flow-based sampling are discussed more in Section 4.

storm was still in accordance with the storm criteria set forth in the FSP summarized in Section 4.1.

Eleven of the 17 activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP. Eight of the samplers that could not be activated or that failed to collect samples were examined to determine why they did not function properly and to make adjustments to improve performance. This evaluation revealed the following:

- One of the samplers (OF-16) could not be activated because it had been damaged due to a failure of the mounting system.
- One of the samplers (OF-M2) could not be contacted to activate the sampler. This could have been caused by a low battery, or poor cell phone reception. The location of the cell phone antenna was adjusted.
- Two of the activated samplers (WR-145 and WR-147) had jammed distributor arms. It was found that the bottle rack was improperly installed. This was repaired and all other samplers were checked.
- Three stations (OF-49, OF-22, and OF-22C) did not draw any water.
    - At OF-49 the error message said "no more liquid." The flow data showed that the water level in the pipe was high only for a short period of time, but that the high water level did not correspond to high flows, so the sampler was triggering at the wrong time. Because of the difficulty in measuring flow, the Stormwater Technical Team recommended and EPA agreed, as documented in Appendix Y, decided to change this site to a time-based sample collection triggered on the basis of water level.
    - At OF-22 and OF-22C, the error message showed "no liquid detected." In looking at flow data, it showed the water level at these stations was too low or too fast and turbulent for the sample tube to collect water. To correct this problem, for subsequent events at OF-22 and OF-22C the sampling pickups were placed in "flow tubes" installed to increase water level and decrease turbulence. The "flow tube" was simply a section of pipe that was installed with the downstream end elevated to create a backwater in the tube that was deep enough to collect a sample. This modification was consistent with FSP allowance for a variety of methods

for installing equipment and was not considered a deviation from the FSP.

- It was found at WR-67 that the sampler pump failed. The original ISCO was removed and replaced by an extra ISCO. The sampler was shipped to ISCO for evaluation of the malfunction, which was not definitively diagnosed by ISCO. ISCO replaced the pump.

3.3.2 Response to Storm 2a: Sample Date April 9, 2007

By storm 2, 22 ISCO automated samplers had been installed. On the evening of April 6, 2007, all 22 ISCO automated samplers were activated via cell phone modem in anticipation of a storm that was forecasted to provide between 0.35 and 0.50 inches of precipitation starting later that night. The sampler was not installed at WR-218 due to site access issues. Detailed programming information is shown in the Site-Specific Sampling Reports in Appendices A to W. A flow-based program was activated for 16 of the samplers. Six samplers were programmed on a timed basis because of difficulties measuring velocity and consequently flow. Figure 3-2 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 2.

The first measurable rainfall was recorded at 2:00 a.m. on April 7. Depending on the rain gage, the total rainfall for the storm ranged between 0.47 and 0.58 inches and lasted 12 hours. The antecedent dry period was between 5½ and 6½ days, with no rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3.3b. This storm was in accordance with the storm criteria set forth in the FSP, summarized in Section 4.1.

As shown in Table 3-2, 19 of the activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP.

The three samplers at stations that failed to collect samples were examined to determine, if possible, why they did not function properly and to make adjustments to improve performance. This evaluation revealed the following:

- The sampler pump failed at two stations (WR-96 and OF-22B). The samplers were removed from these two stations. A sampler was reinstalled at WR-96, but no sampler was reinstalled at OF-22B because there were no additional reserve samplers available. These pumps were shipped to ISCO for evaluation of the malfunction, which was never definitively identified by ISCO. ISCO replaced the pumps.

- The flow meter failed at OF-22C. Upon investigation, it was found that the flow meter had been dislodged from the mounting sleeve. The flow meter was replaced and remounted.

3.3.3 Response to Storm 2b – Sample Date April 9, 2007

As discussed above, samplers at 22 stations were activated on the evening of April 6. The storm referred to as Storm 2a started at approximately 1 a.m. on April 7 and the last measurable rain was at 2 p.m. on April 7. Since this was a weekend storm, samples were not retrieved from the field until Monday April 9 and the automated samplers continued collecting samples until all bottles were full. In this weekend period, a 24-hour dry period occurred and a second storm (2b) started at 3 p.m. on April 8th, which also met the FSP storm criteria.

At most stations, the bottles from the second storm were discarded because there were only a few aliquots of sample. However, at two stations (WR-67 and OF-M2), it was determined that there were two useable sets of samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP. At both stations, the first four bottles were samples from Storm 2a, the fifth bottle contained only baseflow and was discarded, and the last three bottles were samples from Storm 2b. Consequently, two sets of samples were prepared for analysis from the aliquots collected at these stations. Although such a procedure is consistent with the FSP requirements, this unusual situation was discussed with and accepted by the Stormwater Technical Team, with EPA approval. (see emails in Appendix Y).

The total rainfall for Storm 2b ranged between 0.27 and 0.31 inches and lasted approximately 10 hours, depending on the rain gage. The antecedent dry period was between 24 and 25 hours with no rainfall. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3c.

3.3.4 Response to Storm 3 - Sample Date April 18, 2007.

On the morning of April 16, 2007, all 21 ISCO automated samplers installed at that time were activated via cell phone modem in anticipation of a storm that was forecasted to provide between 0.2 and 0.35 inches of precipitation starting later that morning. No sampler was installed at OF-22B as the sampler was still at ISCO being repaired. Additionally, the sampler was not installed at WR-218 due to site access issues. Detailed programming information is shown in Table 3-2 and in the Site-Specific Sampling Reports in Appendices A to W. Program 1, which was developed for total precipitation between 0.2 and 0.35 inches, was activated for 15 of the samplers. Again, six samplers were programmed on a timed basis because of difficulties measuring

velocity as described previously. Figure 3-3 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 3

The first measurable rainfall was recorded at 9:00 a.m. on April 16. Depending on the rain gage, the total rainfall for the storm ranged between 0.30 and 0.49 inches and lasted approximately 34 hours. The antecedent dry period was approximately 2 days, with no rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in 3-3d. This storm was in accordance with criteria set forth in the FSP, as summarized in Section 4.1.

During this storm, 13 of the 21 activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP (Table 3-2). Samples were not successfully collected at other stations for the following reasons.

- Samples from three stations (OF-22, HWY 30, and WR-14) were discarded because insufficient sampling volume was collected over the storm interval to meet the FSP criteria, or less than half of the storm hydrograph was sampled.
- Four stations (WR-161, WR-96, WR-145, and OF-49) did not receive adequate precipitation to trigger the sampler.
- One site (OF-M2) did not collect a sample because the battery died.

3.3.5 Response to Storm 4 - Sample Date April 23, 2007

On the morning of April 21, 2007, all 21 ISCO automated samplers installed at that time were activated via cell phone modem in anticipation of a storm that was forecasted to provide between 0.2 and 0.35 inches of precipitation starting later that day. The sampler for OF-22B was still in for repair at ISCO, so it was not installed. Additionally, the sampler from OF-18 was removed, cleaned, and reinstalled at WR-218 before this sampling event. The rationale for this was that three samples had already been collected at OF-18 while no samples had been collected at WR-218, and the remaining ISCOs were still being repaired. Detailed programming information is shown in the Site Specific Sampling Reports in Appendices A to W. Program 1, which was developed for total precipitation between 0.2 and 0.35 inches, was activated for 14 of the samplers. Seven samplers were programmed on a timed basis because of difficulties measuring velocity as described previously. Figure 3-4 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 4. The total rainfall for the storm ranged between 0.25 and 0.29 inches and lasted approximately 4 hours. The antecedent dry period was approximately 2 to 3 days with no rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in

Table 3-3e. This storm was in accordance with the storm criteria set forth in the FSP, as summarized in Section 4.1.

As shown in Table 3-2, 12 of the activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP. For three stations (WR-22, WR-4*, and OF-M1), only dissolved metals still needed to be sampled; all other analytes had been sampled three times per FSP requirements. Because the samples were not collected within 24 hours as recommended, the Stormwater Technical Team decided and EPA agreed that dissolved metals could not be measured, so the samples were discarded. (See Section 4.3 and Appendix Y describing the overall decision of retrieval of samples within 24 hours by the Stormwater Technical Team.)

Samples were not collected during this storm event because of the following reasons.

- Three samplers (WR-107, OF-22, and HWY 30) did not collect runoff over any of the falling limb of the storm hydrograph and were discarded as not valid, in accordance with the FSP.
- One site (WR-142/145) had construction activities that intercepted the runoff, and therefore, the sampler did not collect enough water. (Only one aliquot in Bottle 1 was collected when the sampler was triggered, and nothing else for the duration of the storm.)
- Another sampler (WR-161) did not activate for still unknown reasons.
- The battery died unexpectedly at the WR-218.

3.3.6 Response to Storm 5 - Sample Date May 3, 2007

On May 1, 2007, all 23 ISCO automated samplers installed were activated via cell phone modem in anticipation of a storm that was forecasted to provide between 0.2 and 0.35 inches of precipitation starting later that night. Detailed programming information is shown in the Site Specific Sampling Reports in Appendices A to W. Program 1, which was developed for total precipitation between 0.20 and 0.35 inches, was activated for 18 of the samplers. Five samplers were programmed on a timed basis because of difficulties measuring velocity as described previously. Additionally, because of storm attenuation by the stormwater infrastructure, the frequency of sampling was reduced from 20 minutes to 10 minutes at OF-49. Figure 3-5 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 5.

The first measurable rainfall was recorded at 10:00pm on May 1, 2007. Depending on the rain gage, the total rainfall for the storm ranged between 0.31 and 0.61 inches and lasted between 19 and 23 hours. The antecedent dry period was approximately 9 to 10 days, with no rain in the 24 hours preceding the storm. Complete storm statistics by

sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3f. This storm was in accordance with the storm criteria set forth in the FSP, as summarized in Section 4.1.

Nineteen of the 23 activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP. The reasons for samples not being collected at four stations were:

- At one site (WR-142/145) a barge under construction intercepted the majority of the precipitation that would have fallen on the basin, so there was insufficient flow to collect samples. After this storm event, the sampler was moved from WR-145 to WR-142 in order to avoid the barge construction. This site relocation was discussed with the Stormwater Technical Team and approved by EPA (Appendix Y).
- At OF-49, the sampler tube did not collect any samples due to low water levels.
- At OF-22C, the sampler did not trigger because flows were much lower than anticipated due to lower base flow than in previous events. The trigger was adjusted for the next sampling event.
- The sampling interval over which volume was collected at OF-M1 did not meet FSP criteria, so the sample was discarded.

3.3.7 Response to Storm 6 – Grab Sample Date May 21, 2007

On the afternoon of May 20, 2007, 10 ISCO automated samplers were activated via cell phone modem to collect grab samples. The 10 locations for grab locations were those specified by the FSP for collection of filtered/unfiltered sample pairs for the evaluation of chemical partitioning characteristics in stormwater. Figure 3-6 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 6.

The first measurable rainfall was recorded at 5 a.m. on May 20. Depending on the rain gage, the total rainfall for the storm ranged between 0.23 and 0.26 inches and lasted approximately 13 hours. The antecedent dry period was approximately 29 hours, with no rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3g. This storm was in accordance with the storm criteria for a grab sampling event set forth by the Technical Team, as summarized in Section 4.3.

Seven of the activated samplers provided samples collected during the targeted period of the hydrograph (with the exception of WR-161) with sufficient volume meeting FSP storm flow requirements (Table 3-2). The samplers installed at OF-22 and OF-22B did

not function properly due to inadequate depth of water at the pick up tube despite the previous installation adjustments intended to prevent this problem. The sampler at WR-96 did not function due to a programming error.

3.3.8 Response to Storm 7 – Grab Sample Date June 6, 2007

On the afternoon of June 4, 2007, four ISCO automated samplers were activated via cell to collect additional grab samples to complete the grab sampling requirements of the FSP. Three of the four samplers activated (OF-22, OF-22B, and WR-96) had failed to collect adequate samples in the last grab event. The fourth sampler (WR-161) was activated because the sample from the first grab sample event was not taken at the beginning of the storm in accordance with the Stormwater Technical Team instructions. It was decided that a second sample should be taken. Figure 3-7 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 7.

The first measurable rainfall was recorded at 7 a.m. on June 5. Depending on the rain gage the total rainfall for the storm ranged between 0.15 and 0.23 inches and lasted between 10 and 12 hours. The antecedent dry period was approximately 12½ days, with 0.01 inches or less of rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3h. This storm was in accordance with criteria for a grab sampling event set forth by the Stormwater Technical Team, as summarized in Section 4.3.

All four activated samplers provided adequate sample volume collected during the targeted period of the hydrograph meeting FSP storm flow sampling requirements (Table 3-2).

3.3.9 Response to Storm 8 – Sample Date June 10 and 11, 2007

On the morning of June 9, 2007, 18 of the 23 installed ISCO automated samplers were activated via cell phone modem in anticipation of a storm that was forecasted to provide between 0.35 and 0.50 inches of precipitation starting later that morning. Five samplers (OF-18, OF-19, WR-107, WR-22, and WR-4*) were not activated because an adequate number (per the FSP) of samples had already been collected from these stations. Program 2, which was developed for total precipitation between 0.35 and 0.5 inches, was activated. However, due to continuing difficulty in measuring flow and the likelihood of storms meeting the minimum FSP requirements diminishing, 12 of the samplers were programmed to sample on time-based programs, with the sample intervals ranging from 5 to 15 minutes. Figure 3-8 shows a plot of the measured precipitation at rain gages operated in the project area for Storm 8.

The first measurable rainfall was recorded at 9 a.m. on June 9, 2007. Depending on the rain gage, the total rainfall for the storm ranged between 0.28 and 0.39 inches and lasted between 6 and 7 hours. The antecedent dry period was approximately 2 days, with no

rain in the 24 hours preceding the storm. Complete storm statistics by sampling location including dates of rainfall and automated sample collection are summarized for this storm in Table 3-3i. This storm was in accordance with the storm criteria set forth in the FSP, as summarized in Section 4.1.

Fifteen of the 18 activated samplers provided flow-weighted samples that had sufficient volume collected over storm flow conditions, with aliquot collection intervals representative of flow variability and the duration of the composite spanning the appropriate portion of the storm as specified in the FSP. Because the precipitation from this event occurred Saturday June 9, only 13 stations were accessible to collect samples on Sunday June 10. Two additional stations (WR-123 and WR-384 on the Schnitzer site) were collected the following day.

Samples were not successfully collected during this event for the following reasons.

- Two samplers (OF-22B and OF-M2) were unable to be contacted to trigger the samplers.
- The sampler at OF-22C never triggered because the flow was too shallow.

3.4 SEDIMENT TRAP INSPECTIONS

After sediment traps were installed as described in Section 3.2, they were inspected approximately once a month during the sampling period. The inspection dates and observations/actions at each inspection are summarized in Table 3-4, as well as in the Site-Specific Sampling Reports in Appendices A to W. At each inspection, the sediment traps were removed, the amount of sediment was recorded, and the sediment traps were reinstalled. Also noted in Table 3-4 and Appendices A-W are instances where samples were removed and archived, or samples bottles were replaced due to damage and/or spills.

Of particular note were the following actions that were not specifically anticipated by the FSP:

- At WR-96, from March 26 to May 1, the trap bottle caps were inadvertently left on after they were capped during the weir installation.
- On March 27, the OF-16 sediment trap bottles were found to be damaged and were replaced with new bottles without archiving any sediments because the damaged bottles were empty.
- On April 5, the OF-22 sediment trap bottles were removed due to a reported hydrocarbon leak into the storm drain. These bottles were

capped and archived and not used in sediment sample composites because they did not contain any sediment.

- On May 1, the sediment traps at WR-145 were removed and relocated to WR-142 along with stormwater samplers as discussed in Section 3.3.5. The sample volumes obtained for WR-142 were retained for eventual compositing with WR-145 sample volume per recommendation of the Stormwater Technical Team and agreement by EPA (see emails in Appendix Y).
- On May 3, the OF-22 sediment trap bottles were removed due to a reported mineral oil spill into the storm drain. These bottles were capped and archived but were used in sediment sample composites since very limited volume was collected. The sample results would be expected to not be generally representative for petroleum related compounds (e.g., PAHs), but should be representative for other types of compounds (e.g., PCBs) not related to this discharge. As shown in Table 6-3, because of limited volume, only PCB's and total carbon analyses were performed, therefore, the results should be unaffected.
- At OF-49, from June 6 to July 3, the caps were inadvertently left on the bottles after they were capped during inspection.

3.5 REMOVAL OF THE SAMPLING NETWORK

Anchor and Integral staff began removing the ISCO automated samplers and the sediment trap hardware on July 15, 2007. The final pieces of equipment were removed on August 20, 2007.

Upon removal from the field, the final data were downloaded from each ISCO sampler and added to the Flowlink database. The samplers were decontaminated and stored at the LWG Field Laboratory for potential future use. Worn items such as the peristaltic pump tubes and transfer arm tubes were discarded, as were the sample pickup tubes.

Installation hardware such as slip rings, stainless steel catch basins, and sediment trap mounting hardware were also removed, decontaminated, and stored at the LWG Field Laboratory. Batteries were recharged to prevent deterioration and also stored at the lab.

The cellular phone accounts for the ISCO samplers have been kept open pending direction from LWG on any potential future use of these samplers.

4.0 Stormwater Composite Sample Field Sampling Procedures

As described in Section 2.1.1 of the FSP, flow-weighted composite samples were collected to obtain Event Mean Concentrations (EMCs) of chemicals found in the stormwater. Flow-weighted, whole water (unfiltered) sample aliquots were collected over the course of the storm event with ISCO 6712 automatic samplers. The following sections describe the general field sampling procedures as they applied to all stations. Site- specific details are provided in the Site-Specific Sampling Reports in Appendices A through W.

4.1 WEATHER TRACKING

Weather forecasts from various sources were normally reviewed twice daily during the sampling period. The frequency and the number of sources reviewed increased as storm systems approached the Site. The following forecasting tools were used to track storms and predict precipitation totals:

- National Weather Service Northwest River Forecast Center
  http://www.nwrfc.noaa.gov/weather/10_day.cgi

- National Weather Service Forecast Office, Portland, OR,
  http://www.wrh.noaa.gov/forecast/MapClick.php?site=PQR&llon=-123.448747&rlon=122.176247&tlat=46.154584&blat=44.882084&smap=1&map=0&map.x=147&map.y=108

  http://www.wrh.noaa.gov/forecast/MapClick.php?site=pqr&smap=1&textField=45.52361&textField2=-122.675&FcstType=graphical

- National Weather Service
  http://www.weather.gov/forecasts/graphical/sectors/pacnorthwest.php

- Oregon Climate Service
  http://www.ocs.oregonstate.edu/index.html

- Acuuweather.com
  http://www.accuweather.com/radarlocal.asp?partner=forecastfox&traveler=1&zipcode=98359&level=local&anim=0&type=re2&site=KPDX

- Local television stations
  http://www.kptv.com/weather/index.html
  http://www.kgw.com/weather/?tn

The storm conditions targeted for sampling as described in the FSP were to meet both of the following criteria:

- Storms predicted to produce more than 0.2 inches of rainfall over a minimum of a 3-hour period, not to exceed approximately 2.25 inches in a 24-hour period (equivalent to the 2-year event)
- Storms preceded by at least a 24-hour dry period (less than 0.1 inches rainfall).

Once suitable a suitable storm event was identified, the sampling teams were alerted to be on standby to trigger the samplers and to retrieve the samples. Additionally, once suitable storm events were identified, the sampling team began contacting the LWG site contacts to alert them that access would be needed to retrieve the samples and to arrange flagging where needed to access stations in high traffic areas.

4.2 PROGRAM SELECTION AND ENABLING OF ISCO SAMPLERS

As described in Section 2.1.1 of the FSP, at each sampling location, drainage basins were evaluated for basin size and runoff characteristics to facilitate calculation of expected discharge flows for a variety of storm conditions meeting the storm criteria. The Santa Barbara Unit Hydrograph (SBUH) method, commonly used in the City of Portland, was used to estimate the runoff volumes for specified storm totals. This method uses Soil Conservation Service (SCS) curve numbers (CN) to describe the resultant runoff from a particular land area. For each sampling site, a CN was selected based on professional judgment that reflected the amount of impervious area, pervious area, and surface roughness, since no flow records existed. As flow data was collected during the sampling period, the CNs were refined to better match the measured runoff. The runoff calculations for each sampling site can be found in their respective Site-Specific Sampling Reports in Appendices A to W.

All the samplers were initially programmed to collect flow proportional sample volumes per the FSP. Samplers were pre-programmed to collect aliquots of stormwater following a "trigger" for each storm event, usually an increase in flow or water level. The "trigger" for each site varied from site to site, as some stations had substantial base flows.

Initially the ISCO automated samplers were programmed to collect a flow proportional sample at regular time intervals as described in the FSP. During a testing event before most of the automated samplers were deployed, it was found that the automated sampler did not collect the samples as anticipated based on the technical manual and discussions with the vendor. After several communications with TeleDyne ISCO technical support, it was found that the samplers could not operate in the mode desired with a multiple bottle set up and could only function in the desired mode with a single sample collection jar. Consequently, the automated samplers were reprogrammed and samples were collected on an irregular time basis where the frequency of aliquot collection is based on the volume of water that has passed the flow meter since the previous aliquot collection. The automated sampler collected the stormwater in 180-ml increments or

ten aliquots per sample jar. The frequency of sampling was dependent on the flow rate and the sampler programming that was unique to each sampling site. As the basin runoff characteristics were better defined, the programming was similarly refined.

Flow-based samplers were pre-programmed with up to four programs to cover the following ranges of precipitation events: 0.2-0.35 inches, 0.35-0.50 inches, 0.50-0.75 inches, and 0.75-1.5 inches. Based on the anticipated precipitation, the samplers were contacted via the cell phone modems and one of the four programs was selected and started. The samplers then automatically began to collect aliquots of stormwater following the site-specific flow "trigger" for each storm event. The programs selected for each event are identified in Section 3.3, and the specific flow trigger for each event is included in the Site-Specific Sampling Reports in Appendices A to W. For stations with base flow, the trigger was set to start sampling when water levels or flow rose above base flow levels.

During the course of the sampling, it became necessary to change sampling strategy at some stations. This second sampling strategy is termed "time-based" sampling. Table 3-2 shows when this strategy was used. With time-based sampling it is not necessary to make a prediction of the volume of runoff expected to be generated by various storms. The strategy was primarily used at stations where it was difficult to predict and/or measure stormwater flows. Reasons for this included:

- For initial sampling events at some stations, there was very little or no antecedent flow record with which to help choose a flow-based sampling program.
- For some stations, the area-velocity meter could not accurately measure the velocity of the shallow water in the pipes (primarily at large infrastructure stations with shallow water during the flow conditions of the sampling period).
- For the last sampling event, there was very little or no antecedent flow record to predict flows after a long dry period with less base flow and more tree cover.

At these stations the sampling scheme was changed to a time-based system in which the sampler collected aliquots on a uniform time basis after an initial "trigger" based on either increased flow or water level. During the compositing process, sample bottles were manually weighted for flow based sampling using the parameters that depending on the availability of reliable data. In order to find the contribution of each sample bottle, relative cumulative flow was the preferred parameter, with relative cumulative water level used if flow data was not reliable. In one case, rainfall measurements were used. The Site-Specific Sampling Reports in Appendices A to W describe the type and value for the triggers for each site and sampling event, as well as what measurement was used as the basis for compositing. The sample frequency for each event varied between 5 and 20 minutes and was based on the expected duration of the storm event.

The time-based approach was discussed with the Stormwater Technical Team for OF-49 and WR-147 stations (see emails in Appendix Y) early in the sampling project. It was also subsequently used at several other stations, due to similar technical issues encountered.

Regardless of whether flow-based or time-based sampling was used, the overall objective was to collect a composite sample that was represented by ten aliquots collected into seven or eight 1.8-liter bottles over the entire storm hydrograph (the eighth bottle in some samplers was used for a field blank for quality assurance/quality control [QA/QC]).

4.3 SAMPLE RETRIEVALETRIVAL AND DATA DOWNLOADING

As soon as practicable after a storm, sampling teams were deployed to recover the samples. Samples were recovered and data downloaded consistent with the procedures in the FSP.

In some cases, the time to retrieve samples was increased due to site access issues (e.g., over the weekend or the need to have traffic flaggers deployed to the site). The FSP requires samples be retrieved within 24 hours after the end of sampling event and then processed within 12 hours after retrieval. Due to these issues, in some cases the target for sample retrieval was not met. The specific instances are shown in Table 4-1 and discussed more in Section 4.9 - FSP deviations. In all cases, the samples were processed within 12 hours after retrieval.

Early in the storm event response process, it was recognized that weekend site access could not easily be attained for the majority of sampling stations. Consequently, any storm events ending on Saturday or Sunday morning could not be retrieved within 24 hours with available Monday morning access. This created the potential to miss a number of storms and thereby cause substantial data gaps given the limited spring timeframe available for sampling. It is notable that more than half the sampled storms (Events 1, 2, 4, 6, and 8) happened to occur over the weekend in this period. This issue was discussed with the Stormwater Technical Team on April 9. It was recommended and EPA agreed that the 24- hour retrieval time should be maintained whenever possible, but that if this was not possible for a weekend storm, the samples would be retrieved as soon as possible. Samples obtained after 24 hours, would not be analyzed for filtered (dissolved) metals or dissolved organic carbon (DOC), but would be analyzed for total metals and total organic carbon (TOC), as well as all other conventional and organic parameters. After the April 9 event, the Stormwater Technical Team recommended and EPA agreed that DOC could still be analyzed for samples retrieved after 24 hours.

4.4 STORMWATER FLOW/RAINFALL EVALUATION AND COMPOSITING

The Anchor sampling coordinator initially reviewed the precipitation data to ensure that the actual storm event met the storm requirements described previously in Section 4.1. The precipitation was found to be variable in the Portland metropolitan area, with the project site frequently in the rain shadow of the Tualatin Mountains. After reviewing the records from the several local precipitation gages operated by the City of Portland's Bureau of Environmental Services that were located within the project area, a precipitation gage was assigned to each specific sampling site based on vicinity to the site (Figure 4-1) (http://or.water.usgs.gov/non-usgs/bes/). Although viewed on-screen when the flow evaluations were made, the data was later added to the Flowlink database and is presented in the Site-Specific Sampling Reports in Appendices A to W, as well as in Figures 3-1 through 3-8. Although City of Portland rain gage data is kept in Pacific Standard Time year-round, the data was adjusted to Daylight Savings Time before adding to the database.

The Anchor sampling coordinator reviewed the storm event data in the Flowlink database and provided site-specific compositing instructions on the Field Sampling Chain of Custody Form. For flow-based sampling and per the FSP, these instructions typically identified which of the eight sample jars to use when creating the composite. For example, at stations with substantial base flows, the aliquots collected at the beginning or end of the sampling event may have been largely base flow or non-stormwater discharges. Under this circumstance, the water collected at the start and end of the sampling would be excluded from the composite. Additionally, bottle volumes were recorded and compared with sampling reports to make sure the volumes were generally consistent. For example, a bottle containing seven sample aliquots should be 70 percent full, in comparison with a bottle containing 10 sample aliquots being 100 percent full. In general, these procedures were consistent with the process described in the FSP.

At the time-based sampling stations, bottles containing aliquots consisting of primarily base flow were discarded and the composite was created by proportioning the sample bottles based on the mean flow (if measurable at the site) or mean depth of water or rainfall during the time the aliquots were collected to achieve a "manually flow-weighted composite." Where water levels or rainfall were used because flow could not be accurately measured, this is not technically a flow-weighted composite sample, but rather the water level or rainfall is used as a surrogate measure of flow. The time-based sample compositing calculations including the measure used to composite are shown in tables in the Site Specific Sampling Reports in Appendix A through W.

The Anchor sampling coordinator then discussed the compositing instructions with Integral LWG Field Laboratory coordinator. Once they were both satisfied that the compositing instructions were clear, the Anchor sampling coordinator signed the Field Sampling Chain of Custody Form and relinquished custody of the samples to the Integral LWG Field Laboratory coordinator. The Integral coordinator signed the form and attached it to the sample cooler until the samples could be processed.

A summary of compositing for each site during each event is included in the site specific appendix attached to this report. The Field Sampling Chain of Custody Form for each sampling event is provided in Appendix X.

4.5 SAMPLE PROCESSING AND HANDLING

Once the stormwater composite scheme was determined as discussed above, the composite stormwater processing procedures generally followed those detailed in the FSP (Anchor and Integral 2007a). Table 4-2 summarizes composite stormwater collection by site, event, and analyte group. Deviations from the FSP are discussed in Section 4.9. As shown in Table 4-2 in a number of instances particular analytes were not collected at certain stations. In most cases, there was insufficient sample volume available at that station and, in these cases, the priority order of analyses required by the FSP was followed. Also, in some cases retrieval target times were not met (as discussed previously), and consequently dissolved metals analyses were not performed. In all cases, the samples were processed within 12 hours after retrieval.

4.6 FIELD PARAMETER MEASUREMENTS

The FSP (Anchor and Integral 2007a) stated that water quality parameters for stormwater outfall samples would be measured in the field. Given that there was considerable variation in visible water quality across the bottles in a particular sampler and that it was not known at that time which bottles would eventually be included in the composite sample, it was determined that measurement of field parameters prior to compositing would likely be non-representative of the eventual composite sample. Instead, individual stormwater sample containers were brought back from the field, composited in 20 L glass carboys and the water quality parameters measured from the sample composites. Depending on the final composite volume, an aliquot of sample (approximately 100 to 200 mL) was either:

- Removed immediately for measurements of water quality parameters, or
- In cases of very limited composite volume, the aliquot was collected immediately after filling the priority sample containers for chemical analyses.

In certain cases, not enough volume remained to measure water quality parameters. This modification to the FSP procedures is included under deviations in Section 4.9.

4.7 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field QC samples are used to assess sample method variability (e.g., replicates) and sample variability (e.g., duplicates), evaluate potential sources of contamination (e.g., equipment rinsate and trip blanks), or confirm proper storage conditions (e.g., temperature blanks). Additional details on field duplicate samples and field QC samples are described in the QAPP Addendum 8 (Integral 2007). Field QC samples were collected for each sampling event in accordance with the FSP.

4.7.1 Field Duplicates

Field duplicate samples were collected for each water sampling event in accordance with the FSP. In order to generate sufficient additional volume (6.2 L as per FSP Table 2-3) to analyze for the full suite of analytical parameters in a field duplicate sample, and because of limitations on the maximum sample volume that could be collected in each ISCO sampler, volume for field duplicates were collected from multiple sample locations during each storm event. For each storm event, additional volume from one station would be used to create field duplicates for total metals analysis, additional volume from another station would be used to create field duplicates for PAH analysis, and other parameters, as shown in Table 4-3.

Due to variations in actual runoff versus that predicted by the program or sampling approach used, it could not be determined in advance which stations would have sufficient volume for field duplicates. Consequently, the locations of field duplicates were determined based on the sample volumes available during each storm event. Any additional volume from a given station was aliquoted for field duplicate analysis in accordance with the analytical priorities established in the FSP (Table 2-4a). Once sufficient volume had been collected to create all field duplicate analyses, any additional sample volume from a given station was then used in the same manner to create laboratory quality control samples (i.e., matrix spike or laboratory duplicates following the analysis priority established in the FSP). Field duplicates are summarized for the stormwater composite samples in Table 4-3. For all water sampling events, field duplicates were collected at the 5 percent frequency listed in the FSP (one per 20 samples).

As shown Table 4-3, duplicate samples were collected for storm events 1 through 5 for the total set of original samples across all events meeting the 5 percent duplication (one per 20 samples) required in the FSP. Storms 6 and 7 were selected for grab sampling and are discussed in Section 5. Duplicate samples were not collected for storm event 8 because the total number of duplicate samples already available was sufficient to meet FSP requirements.

4.7.2 Equipment Rinsates and Temperature Blanks

The FSP requires one equipment rinsate blank prior to deployment of the ISCO samplers. This blank was collected by pumping deionized water through a representative ISCO sampler prior to deployment and into a clean sample bottle. This was collected with the full ISCO sampler set up including intake screen, Teflon lined sampler hose, and silicone pump and distribution arm tube installed in the sampler. Sufficient volume was collected to conduct all analyses described in Section 7.

The FSP only requires the above single equipment rinsate blank prior to deployment of the ISCO samplers. To provide additional information about the decontamination procedures and identify possible contamination sources throughout the entire sample collection and compositing sequence, the following additional equipment and/or rinsate blanks were created and analyzed as discussed in Section 4.9:

- Sediment trap rinsate blank
- Sediment trap bottle rinsate blank
- ISCO tubing rinsate blank
- Additional ISCO rinsate blank through tubing and sampling arm only
- Additional ISCO rinsate blank through tubing, sampling arm, and ISCO bottles
- Stormwater composite equipment rinsate blank

In each case, all rinsate blank samples were treated identically to any other water sample described in the FSP and QAPP Addendum in terms of storage, transport, analyses, and laboratory QA/QC procedures.

Per the FSP, temperature blanks are used to measure the temperature inside the cooler upon receipt to the laboratory. One temperature blank was prepared and submitted with each cooler shipped to the analytical laboratory. The temperature blank consisted of a sample jar containing deionized water and labeled “temp blank” and packed into the cooler in the same manner as the rest of the samples.

4.7.3 Field Blanks

As described previously in Section 4.2, a select number of ISCO samplers contained a collection vessel designated as a field blank. The field blank simply consisted of a blank bottle programmed to not collect a stormwater sample. Upon arriving at the lab, the field retrieval team determined if the Field Blank bottles were a valid sample (i.e., no water was collected in container and jar intake). The field blank bottles were given to the composite team and processed as follows. Columbia Analytical Service (CAS) deionized water was poured into each of the three (at a minimum) field blank bottles.

Blank bottles were collected from several stations and used in the development of one blank sample as noted in Table 4-3. The water was then transferred to a carboy designated for a field blank and processed following the same procedures as completed for the composite samples. The locations from which field blanks were prepared for each sample event are shown in Table 4-3. For all water sampling events, field blanks were collected at the 5 percent frequency listed in the FSP (one per 20 samples).

4.7.4 Laboratory QC Samples

Additional volume for laboratory QC samples was collected for each stormwater sampling event in accordance with the FSP and QAPP. To generate sufficient additional volume (approximately 12 L) for the full suite of analytical parameters for laboratory quality control samples (i.e., matrix spike, matrix spike duplicate, or laboratory duplicate), additional volume for lab QC analyses was collected from sample locations, as available, after collection of the required volume of water for the analytes of interest. Therefore, volume for laboratory QC analyses was collected from multiple samples for each event. For the stormwater sampling events, the additional volume was collected for analyses in accordance to the priorities established in the FSP and was generally sufficient to meet requirements as the FSP. The FSP criteria of 5 percent (one QC per 20 samples) was met for all analyses except for pesticides. There was insufficient volume to perform matrix spike/matrix spike duplicate analysis for pesticides. Instead, the laboratory analyzed duplicate laboratory control samples as laboratory QC for all pesticide analyses. Additional information on the laboratory QC samples will be included in the Stormwater Site Characterization Summary Report.

4.8 FIELD DOCUMENTATION

All field activities and observations were noted in a field notebook dedicated to each site during fieldwork. These notes include diagrams from the initial site reconnaissance, driving instructions to the site, site contact information, site-specific access restrictions, measurements taken when setting up the sampling equipment, and maintenance activities such as changing batteries or peristaltic pump tubes. Additional notes were taken on the Field Sampling Chain of Custody Form regarding the time of retrieval and the appearance of the samples. Copies of key pieces of information can be found for each sampling site in their respective Site Specific Sampling Reports in Appendices A to W. The original field notebooks have been retained by Anchor in LWG project files.

4.9 DEVIATIONS FROM THE ROUND 3A FSP

Several deviations have been made from the FSP during the course of the sampling activities. Major deviations have been described in previous sections to provide context

and rationale for the deviations. Deviations associated with stormwater composite sampling are summarized in Table 4-4.

As detailed in Table 4-4 the following types of deviations occurred:

Major Deviations Recommended by the Stormwater Technical Team and Approved by EPA

- Some sampling stations were changed as detailed in Table 4-4 and documented in Appendix Y
- In some cases, retrieval of samples occurred more than 24 hours after the collection of the last aliquot. Specific instances of this are noted in Table 4-4 and documented in Appendix Y
- At some sampling stations, use of time-based sampling instead of flow-based sampling methods were used to obtain composite samples. Specific locations are noted in Table 4-4 and documented in Appendix Y.

Other Major Deviations

- The station at Highway 30 was intended to be representative of runoff primarily from a major transportation corridor. The actual sampling location was in a manhole that had input from both the highway and from a side branch draining an industrial area. The intended location of sampling was just upstream of this side branch, when inadvertently the actual sampling location was placed just downstream of this same branch. Thus, the samples collected were influenced by both the highway runoff (5 acres) and industrial land use runoff (13 acres).

- Sulzer – The FSP indicated that WR-4 would be sampled. However, during preparation of this FSR, it was discovered that a different outfall was sampled. Subsequent research, reconnaissance and discussions with Sulzer, DEQ, the City of Portland, and Sulzer's environmental consultants have discovered that multiple conflicting storm drainage and outfall maps exist for the site. The intention of sampling WR-4 was to sample the unique site activities of the Sulzer industrial location. It has been determined that the outfall location sampled as a part of this FSR does not drain the basin intended to be sampled and is not likely to be representative of the unique site activities. Further study is needed to determine the basin draining to the sampled outfall. The outfall identification name for the sampled outfall will be determined as part of the Outfall Verification Study being currently

being conducted by Integral Consulting. Because sample identification sent to the lab refers to WR-4, this FSR will refer to WR-4*.

Minor Deviations

- Use of some alternate phthalate free equipment as noted in Table 4-4,
- Measurement of field parameters on composite samples in the laboratory, rather than in the field as described in the FSP.
- Additional rinsate blanks were collected beyond the single blank identified in the FSP. Specific additional rinsate blanks are detailed in Table 4-4.

Also included under the minor deviation category is that prior to initiation of the sample collection events and processing, an equipment decontamination procedure that was alternate to the FSP procedure was developed for both the composite and grab sampling equipment. The FSP indicated that decontamination of most equipment would likely take place at the LWG Field Laboratory. However, due to the large quantity of ISCO collection vessels and composite glass carboys, CAS laboratories carried out the decontamination of these containers. Other items were decontaminated as needed at the LWG Field Laboratory following the alternate procedure. In this procedure 20 percent hydrochloric acid (HCl) rinse in the FSP procedure was replaced with 10 percent nitric acid. Collection vessels were delivered to the LWG Field Laboratory in cardboard boxes and stored as such until needed.

The alternate decontamination procedure for ISCO glass collection vessels, 20-L glass carboys, and coated stir bars was:

- Wash with soapy water and rinse with tap water
- Rinse with reagent-grade acetone
- Rinse with 10 percent nitric acid (HNO3)
- Rinse three times with deionized water
- Allow to dry
- Cap container with Teflon lined ISCO lids (collection vessels) or aluminum foil (glass carboys)
- Store in cardboard boxes provided (ISCO collection vessels)
- Wrap clean carboys in polyethylene bag and seal
- Store clean stir bars in decontaminated glass jar

The alternate decontamination procedure for Teflon® suction lines and silicon pump head and distributor arm tubing was:

- Thoroughly pump through Liquinox® wash followed by CAS deionized water rinse

The alternate decontamination procedure for ISCO samplers was:

- Thoroughly wash with Liquinox® water followed by CAS deionized water rinse

It is judged by the sampling team that these changes did not negatively impact the quality of the study with the possible exception of the measurement of some field parameters in the field lab and location of the Hwy 30 station. Regarding this first item, as noted in Table 4-4 and discussed previously, measurement of some of these parameters in the field presented different QC or comparability issues that may have been greater in some cases. In many other cases (such as additional rinsate blanks and sampling station changes), the changes were made specifically to improve the quality of the study.

5.0 Stormwater Grab Sample Field Sampling Procedures

As described in Section 2.1.2 and Table 2-4a of the FSP, discrete stormwater grab samples were collected from 10 stations where organics would most likely be detected in stormwater samples. However, as described in Section 2.0 and Table 4-4 of this document, two stations (WR-123 and WR-142) were changed after the FSP was completed. The list of grab sample locations is shown in Table 5-1.

Because the purpose of the grab samples is to collect partitioning (chemical dissolved phase/suspended sediment) rather than loading data, samples were collected early in storm events when the chemical concentrations could be expected to be higher than the event mean concentration (e.g., first flush or rising limb). The grab samples were collected with the ISCO automatic samplers.

5.1 WEATHER TRACKING AND STORM SELECTION

The storm events for grab sampling were selected and tracked using the same methods as described for the composite sampling (Section 4.1). As noted in Section 3, composite stormwater sampling was given the highest priority for the first few storm events. Once several storms had been successfully sampled for composite samples, the sampling team focused on retrieval of grab samples.

At that time the Stormwater Technical Team discussed and EPA agreed on April 30 that the minimum storm criteria for grab sampling could be relaxed from the criteria detailed in the FSP to ensure that grab samples were successfully collected within the limited expected storm activity in the remainder of the spring. It was determined that the grab sampling should be focused on the first flush or rising limb of the hydrograph. Consequently, the actual storm precipitation totals were likely less important for grab sampling, as long as sufficient runoff was generated from the stations of interest. The email discussing this change is included in Appendix Y.

Consequently, the Stormwater Technical Team recommended and EPA directed that, for the remainder of the study, the sampling team would collect composite water samples at all stations where composite data are still needed for any storm that was expected to meet all the FSP storm criteria. If the FSP criteria for rainfall amount or duration were not expected to be met, then the sampling team would collect grab samples at the 10 grab sample stations. However, the 24-hour antecedent dry period storm requirement of the FSP would still be followed for grab sampling. Also, the Stormwater Technical Team recommended and EPA directed that the grab sampling would target collecting samples as soon possible after runoff is observed to start at each site. This is also summarized in Table 4-4 and the email discussing this change is included in Appendix Y.

5.2 PROGRAM SELECTION AND ENABLING OF ISCO SAMPLERS

The ISCO automatic samplers were reprogrammed to collect samples as rapidly as possible after being triggered. Glass sample jars (1.8 liters) were filled every 3 minutes. The 3-minute time period was selected so that the pump arm would have time to move between sample bottles and the sampler could complete its purge process between samples. Either seven or eight jars of stormwater were collected depending on if a particular site was going to be used as a field blank or not.

The samplers were contacted by cellular modem a few hours before the onset of the forecasted storm, and water level triggers were programmed based on the current water levels reported by the sampler. Generally, the minimum water level trigger elevation was 0.1 feet, which is the minimum required to be able to draw a sample without entraining air.

5.3 SAMPLE RETRIEVAL AND DATA DOWNLOADING

The grab sample retrieval and data collection was the same as described for the composite sampling (Section 4.3)

5.4 STORMWATER FLOW EVALUATION

The Anchor stormwater coordinator reviewed the Flowlink data and compared the sampling events to the hydrographs at each site to verify that aliquots were collected during the first flush or early part of the hydrograph.

Compositing instructions were carried out in the same manner as described for composite sampling (Section 4.4) except storm events were evaluated in accordance with Section 5.2 with an emphasis on catching the rising limb of the stormwater hydrograph.

5.5 SAMPLE PROCESSING AND HANDLING

Grab sample stormwater processing procedures generally followed those detailed in the FSP. Table 5-1 summarizes grab sample collection by site, event, and analyte group. Deviations from the FSP are discussed in Section 5.8.

Herbicides at OF-22 were not collected because there was insufficient volume. The sampler drew air due to low water levels or high turbulence for a portion of the beginning of the sampling, so one out of seven bottles was empty and three others were only partially full.

5.6 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field QC samples are used to assess sample method variability (e.g., replicates) and sample variability (e.g., duplicates), evaluate potential sources of contamination (e.g., equipment rinsate and trip blanks), or confirm proper storage conditions (e.g., temperature blanks). Additional details on field duplicate samples and field QC samples are described in the QAPP Addendum 8 (Integral 2007). Field QC samples, collected for each grab sampling event in accordance with the FSP, are summarized Table 5-2.

5.6.1 Field Duplicates

Field duplicate samples were collected for each stormwater grab sampling event in accordance with the FSP and QAPP. As discussed in Section 4.7.1 above, due to limitations on the maximum sample volume that could be collected in each ISCO sampler, additional volume for field duplicates were collected from multiple sample locations. Additional volume for field duplicates were collected from multiple sample locations during the first grab storm event (storm 6). Due to variations in actual runoff versus predicted by the program or sampling approach used, it could not be determined in advance which stations would have sufficient volume for field duplicates. Consequently, the locations of field duplicates were determined based on the sample volumes available during the storm event. Additional volume for field duplicates was collected at stations Saint Johns Bridge (LW3-STW-GW10-SJB-2-T), WR-142 (LW3-STW-GW10-WR142-2-T), and WR-107 (LW3-STW-GW10-WR107-2-T) and analyzed as shown in Table 5-2.

- Duplicate samples were collected for grab storm event 6 and included three duplicates samples. These duplicates were for the total number of original samples (20) across both grab sampling events. (Note that there were fewer than 20 samples for pesticides and phthalates per the FSP.) Overall, this exceeds the 5 percent duplication rate required in the FSP.
- Duplicate samples were not collected for storm event 7 because the duplicates from storm event 6 were sufficient to meet FSP requirements.

5.6.2 Equipment Rinsates and Temperature Blanks

One set of rinsate blanks were collected on the grab sample processing setup as per FSP. Deionized water provided by CAS was poured into a laboratory-cleaned carboy and pumped through the tubing and filters using a peristaltic pump and collected directly into the sample jars. Samples were stored in refrigerators at 4ºC ± 2ºC in the field laboratory and then shipped to CAS (Kelso, Washington) within 48 hours of retrieval. Blanks were analyzed for the constituents listed in Table 7-1. In addition,

some of the additional rinsate blanks described in Table 4-4 have applicability to grab sample QC as well and as noted in that table.

Temperature blanks were employed identical to those described in Section 4.

5.6.3 Field Blanks

As described previously in Section 4.2, a select number of ISCO samplers contained a collection vessel designated as a field blank. The field blank simply consisted of a blank bottle programmed to not collect a grab sample. Upon arriving at the lab, the field retrieval team determined if the field blank bottles were a valid sample (i.e. no water was collected in container and jar intake). The field blank bottles were given to the composite team and processed as follows. CAS deionized water was poured into each of the three (at a minimum) field blank bottles. Sample bottles from several stations were used and combined into one blank sample (Table 5-2). The water was then transferred to a carboy designated for a field blank and processed following the same procedures as completed for the composite samples. The locations from which field blanks were prepared for each sample event are shown in Table 5-2. For all water sampling events, field blanks were collected at the 5 percent frequency listed in the FSP and QAPP (one per 20 samples).

5.6.4 Laboratory QC Samples

Insufficient additional sample volume was collected during any of the grab sample events to perform the laboratory QC analyses specified in the FSP and QAPP. The FSP and QAPP criteria of 5 percent (one per 20 samples) was not met for any of the grab sample analyses due to insufficient sample volume. Instead the laboratory analyzed duplicate laboratory control samples as laboratory QC for all analyses. Additional information on the laboratory QC samples will be included in the Stormwater Site Characterization Summary Report.

5.7 FIELD DOCUMENTATION

Field documentation was collected in the same manner as described for composite sampling (Section 4.7).

5.8 DEVIATIONS FROM THE ROUND 3A FSP

Deviations associated with stormwater grab sampling are summarized in Table 4-4.

A number of the deviations noted in Section 4.9 for composite sampling also apply to grab sampling including:

- Some sampling stations were changed as detailed in Table 4-4 and documented in Appendix Y.
- In some cases, retrieval of samples more than 24 hours after the storm event and/or processing samples more than 12 hours after retrieval. Specific instances of this are noted in Table 4-4 and documented in Appendix Y.
- Use of some alternate phthalate free equipment to that described in the FSP, as discussed in Table 4-4.
- Measurement of field parameters on composite samples in the laboratory, rather than in the field as described in the FSP.
- Additional rinsate blanks beyond the single such blank identified in the FSP. Specific additional rinsate blanks are detailed in Table 4-4.
- Deviations in equipment decontamination procedures.

In addition, as discussed more in Section 5.1, the Stormwater Technical Team recommended and EPA approved relaxing of the storm criteria for grab sampling to be any storm with a 24-hour antecedent dry period.

6.0 Sediment Field Sampling Procedures

As described in Section 2.1.3 of the FSP, sediment traps are useful monitoring tools to help identify chemical concentrations in stormwater sediments. The sediment traps consist of a stainless steel bracket and HDPE bottle. Sediment traps were installed by bolting the bracket directly to the location junction, pipe, or catch basin.

6.1 WEATHER TRACKING

No specific weather monitoring was conducted for the sediment sampling. Precipitation records were gathered from the local precipitation gages operated by the City of Portland. The precipitation data is contained in the Flowlink database and may be used in the future when the chemical analyses of the samples are completed and the Stormwater Site Characterization Summary Report is prepared.

6.2 ANCILLARY FLOW INFORMATION

Per the FSP, the ISCO samplers were set up to record depth, velocity, and flow at 5-minute increments throughout the sediment trap sampling period. Due to high variability in portable flow meters and the short deployment period that makes flow data review and scrubbing difficult, the technical team decided, and EPA agreed that flow data was not intended for use beyond composite sample collection. This data is contained in the Flowlink database and may be used in the future when the chemical analyses of the samples are completed and the Stormwater Site Characterization Summary Report is prepared.

6.3 SAMPLE RETRIEVAL

The sediment traps were deployed from between 74 and 153 days depending on the particular location (Table 6-1). Due access issues, the trap at WR-218 was deployed for less than the 90 days (3 months) required by the FSP, while all other traps were deployed for 90 days or more. The sediment collection vessels were inspected approximately monthly during the sampling period. At some stations, the observed level of sediment was slightly reduced from one month to the next, but this is most likely attributed to settling of the sediment.

The FSP calls for retrieval of sediments in the traps if the bottles are half or more full, archiving of those sediments, and continued deployment with new bottles. In all cases, the accumulations in the sediment trap bottles were much less than this (Table 3-4) and this procedure was not needed. However, the Stormwater Technical Team during a May 18 meeting (see Appendix Y) recommended and EPA agreed to employ the following additional procedures:

- Remove bottles from sediment traps that had 100 percent or more the estimated required volume when they met their 3 month deployment dates. This included:
    - WR-22
    - OF-M1
    - OF-M2
- Remove existing bottles from any sediment trap with more than trace amounts of sediment, replace with clean bottles, and sample and archive available sediments. Table 3-4 notes the locations where this was conducted during the "Beginning of June Removal." Table 6-1 shows two removal dates if the traps were archived in June.
- Extend the sediment trap sampling period through the end of June.

In addition, as noted in Section 3.4 some traps were removed at interim times due to either damage to the traps and or non-representative spills within the basin. Any sediments present were not used in subsequent sample compositing.

The sediment samples obtained from traps after they were removed (with the exceptions noted above) were temporarily archived at the LWG Field Laboratory for later compositing.

An alternate procedure for sediment collection of high volume water sampling and filtration was a potential contingency measure recognized by the FSP. However, use of this technique was discussed in the May 18 Stormwater Technical Team conference call and was not included in the EPA approved contingency measures listed above, and as documented in the email notes for the May 18 meeting (Appendix Y).

All field activities and observations were noted in a field notebook during field work. No specific flow or precipitation data was downloaded for sediment sampling as this information was already being collected and uploaded to the Flowlink database for the composite sampling, described in Section 4.0.

6.4 STORMWATER FLOW, RAINFALL, AND RIVER HEIGHT EVALUATION

No analysis of the stormwater flow has been completed for the sediment sampling. Due to high variability in portable flow meters and the short deployment period that makes flow data review and scrubbing difficult, the technical team decided, and EPA agreed that flow data was not intended for use beyond composite sample collection. The total rainfall during sediment trap deployment is summarized by site in Table 6-1.

Per the FSP, sample locations were chosen at elevations relative to the river water levels such that the risk of river water backing up into stormwater pipes at the sampling location was minimized. River height information was checked routinely as shown in real time by USGS Morrison Bridge River Gage (#14211720) and near term predictions of river height as provided by NOAA's Advanced Hydrologic Prediction Service. The station at OF-18 had the lowest elevation of any location at an elevation of 13.4 feet (City of Portland datum). The river height data were compared to visual observations of water heights within the pipe at OF-18 and to flow sensor water level data on a routine basis, particularly as river water levels rose. The peak river water level observed during the sampling period was 12.22 (City of Portland Datum) measured at 1.55 feet above NGVD of 1929) on March 21 and in-pipe water levels at OF-18 were checked both in the field and via the installed flow sensor. No reaction in standing water height in the pipe at station OF-18 was noted through this peak river level period. River levels returned to 9.28 ft on March 27, and the same checks again indicated no coincident changes in the water level in the OF-18 pipe. The river levels never reached this height again. Given that OF-18 was at the lowest elevation, it is concluded that there was no influence of river water on either sediment trap samples or stormwater samples, which were all collected at times of lower river height, at any sampling location.

6.5 SAMPLE PROCESSING AND COMPOSITING

Sediment trap samples were retrieved (as noted above) and archived at the field laboratory for later compositing (as necessary) with additional trap bottles retrieved from the same location.

Per the FSP, sample processing was conducted at the field laboratory by filtering entire contents of sediment trap bottles and transferring filter and or solid residue into a 16-ounce glass sample jar. At each location there were, at a minimum, two sediment trap bottles to composite. In some cases, some traps had four bottles and at other locations bottles were available from two removal events where noted in Table 3-4.

Samples were processed in the following manner, which differed slightly from the FSP description

- For each station a 16-ounce glass jar was labeled with the appropriate sample identification information.
- Using a decontaminated acrylic filter stand apparatus, glass flask, peristaltic pump and tubing, stainless steel spatula, and 6 micron cellulose filters, the entire contents of each of the sediment bottles were filtered.

- Once most of the water was decanted from the sediment trap bottle, the remaining sediment was then transferred directly to the sample jar.
- A stainless-steel spatula was used to scrape the remaining material off the filter and into the sample jar
- The filtrate was discarded.

Table 6-1 summarizes sediment trap and catch basin sediments collected by site.

As noted previously, insufficient sample volume was available to conduct all FSP analyses from all stations. Thus, once the samples were processed and composited, they were initially frozen to provide additional time for the Stormwater Technical Team to discuss the best use of the limited sample volumes available. To assist in these assessments, some sample volume was utilized to conduct a total solids analysis for each sample. This allowed the dry weight mass of each sample to be estimated, which in turn was used to estimate the number of analyses that could be conducted for each sample. It was recommended by the Stormwater Technical Team and agreed by EPA on August 23 (Appendix Y) that, in general, the samples should be analyzed for chemical categories in the priority order described by the FSP. The only exception to this was that at some stations the FSP indicates that PAHs/phthalates should have a higher priority than pesticides and in the following five cases this priority was reversed: WR-123, WR-14, WR-161, WR-147/148, and OF-49. Table 6-3 shows the analyses that are being conducted for each sediment sample location and where detection limits will likely be elevated above the FSP targets due to limited sample volumes.

6.6 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field QC for sediment trap sediments is summarized in Table 6-2. For the sediment trap samples, preliminary estimates of sediment volume collected indicated that insufficient sediment volume was available to fulfill all field QC sampling needs. As recommended by the Stormwater Technical Team and agreed by EPA during an August 23 meeting (see Appendix Y), additional sediment was collected at selected catch basins for use in field duplicate or for laboratory QC analyses. It was recognized by the Stormwater Technical Team that catch basin sediments are not likely to be physically identical to sediments in sediment traps and that this may contribute to differences between chemical characteristics in catch basin sediments and sediment traps. However, it was also agreed that physical and chemical variability also exists between sediment trap samples, which is factored into the QC process in the FSP. Consequently, it was decided 1) that catch basin sediments can provide useful QC regarding the replicability, accuracy, and precision of the laboratory analysis per the intent of the FSP and 2) that this is preferable to missing analytes in some original samples by using half of the small sample volume available for QC purposes.

6.6.1 Field Duplicates

A field duplicate was collected from station OF-M1 on June 12, 2007. The procedures followed those described previously. Once the entire sample was composited from the sediment trap bottles at this location, the sediment was aliquoted to two separate 16-oz glass sample jars and labeled as such:

- Regular sample: LW3-STW-OFM1-1
- Duplicate sample: LW3-STW-OFM1-2

Due to the subsequent recommendation of the Stormwater Technical Team to use catch basin sediments for QC samples, the sediments from OF-M1 were subsequently recombined and submitted as one regular sample.

Additional sediment was collected from sediment trap catch basins at WR-4* (Sulzer), WR-107 (Gasco), and WR-14 (Chevron). Samples were collected in the following manner:

- Water was siphoned from the catch basin.
- Stainless steel spoons and mixing bowls were used to collect and homogenize sediment from the bottom of catch basin.
- The sediment was transferred to multiple pre-labeled sampler jars and stored on ice for transfer to the field laboratory.
- Samples were stored in refrigerators at $4^{o}C \pm 2^{o}C$ in the field laboratory and then shipped to CAS (Kelso, Washington) within 48 hours of retrieval.

Two samples were submitted for each site, thus producing a field duplicate in each case. In addition, additional sample volume was provided for the original sample to allow for the conduct of all FPS required laboratory QC analyses.

The total number of original sediment samples submitted to the laboratory was 22. Three field duplicates were submitted, which exceeds the one in 20 requirement stated in the FSP.

6.6.2 Equipment Rinsates and Temperature Blanks

Three rinsate blanks, as shown in Table 6-2, were collected on the sample processing setup described previously. Deionized water from CAS was passed through the filter setup using a peristaltic pump. Water was sampled from the setup directly into sample bottles and submitted for the analysis discussed in Section 7.

The FSP calls for one rinsate blank for all analyses and two for phthalates (given that 22 natural samples were submitted). Because three rinsate blanks were prepared and submitted for each analyte, the FSP requirement was met.

Temperature blanks are used to measure the temperature inside the cooler upon receipt to the laboratory as described in previous sections.

6.6.3 Laboratory QC Samples

Because of limited sample mass, it was recommended by the Stormwater Technical Team and agreed by EPA on August 23 that laboratory QC samples will be obtained from catch basin sediment. Additional volume of the same sediments as noted for the field duplicates above were submitted to the laboratory to run QC analyses as designated in Table 6-2. Because 22 natural sediment samples were submitted for analysis, the conduct of three laboratory QC sample analyses exceeds the FSP requirement of one QC sample per 20 natural samples.

6.7 FIELD DOCUMENTATION

Field documentation was collected in the same manner as described for composite sampling (Section 4.7).

6.8 DEVIATIONS FROM THE ROUND 3A FSP

Deviations associated with stormwater sediment trap processing are summarized in Table 4-4.

Deviations that were recommended by the Stormwater Technical Team and directed by EPA, as documented in Table 4-4 and Appendix Y include:

- Use of catch basin sediments for QC samples
- Freezing sediments during analysis discussions to prolong the holding time

In addition, the following minor deviations occurred:

- Sediment traps at WR-218 were deployed less than 90 days (74 days) due to access issues, and deployments at OF-49 and WR-96 were interrupted but still resulted in total deployments of greater than 90 days.

- The sediment processing procedure was refined in the laboratory and differs slightly from the one described in the FSP as discussed above in Section 6.5.

Also, included as a minor deviation is that the equipment was decontaminated between each sample location in the following manner

- Glass and stainless steel equipment – wash with soapy (Liquinox®) water and rinse with tap water, rinse with acetone, rinse with CAS deionized water, rinse with 10 percent nitric, and rinse three times with CAS deionized water.
- Acrylic filter stand and peristaltic pump tubing – wash (or pump) soapy (Liquinox) water, rinse with tap water, and rinse three times with CAS deionized water.

7.0 Laboratory Analyses and Data Management

This section summarizes the chemical analyses that were and are being performed for the characterization of water and sediment samples from the Round 3A stormwater sampling event. Tables 4-1, 5-1, and 6-3 summarize the analyses conducted on each sample. The analytical methods described in the FSP and QAPP are shown in Table 7-1 for water samples and Table 7-2 for sediment samples.

7.1 CHEMICAL ANALYSES

7.1.1 Stormwater Samples

CAS (Kelso, Washington) conducted the chemical analyses of all stormwater samples collected, except for the analysis of PCB congeners by EPA method 1668. All PCB congener analyses were performed by Vista Analytical Laboratory (El Dorado Hills, California). The Stormwater Site Characterization Summary Report will describe the results of those analyses and related QC procedures.

7.1.2 Sediment Samples

CAS (Kelso, Washington) is performing all chemical analyses for sediment samples except for analysis of PCB congeners by EPA method 1668. All PCB congener analyses are being performed by Vista Analytical Laboratory (El Dorado Hills, California). The Stormwater Site Characterization Summary Report will describe the results of those analyses and related QC procedures.

7.2 FIELD LABORATORY ANALYSES

As noted in Section 4.6 all water quality parameters (temperature, DO, specific conductance, pH, turbidity, and oxidation/redox potential [ORP]) were measured in the field laboratory when sufficient sample volume was available. The data for all measured water quality parameters will be included along with the associated chemistry data in the Stormwater Site Characterization Summary Report data report for this program.

8.0 References

AMEC 2007. April 2007 Storm Water Monitoring Report. GE Energy - Energy Services Portland Inspection & Repair Service (I&RS) Center. Prepared by AMEC Earth & Environmental Inc. August 2007.

Anchor Environmental and Integral. March 1, 2007a. Round 3A Stormwater Sampling – Field Sampling Plan (FSP). Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, Seattle, WA.

Anchor Environmental and Integral. March 1, 2007b. Round 3A Stormwater Sampling Rationale (SSR). Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, Seattle, WA.

Ash Creek 2007. Modifications to Storm Water Sampling Program/Recontamination Analysis for Fall 2007 Program Terminal 4, Port of Portland, Portland, Oregon. Memorandum to Nicole LaFranchise, Port of Portland from Amanda Spencer, RG, PE, Ash Creek Associates, Inc.

EPA. 1995. Methods for the Determination of Organic Compounds in Drinking Water,

Supplement III. 500 Series. 1995. EPA-600/R-95/131. U.S. Environmental Protection Agency, National Exposure Research Laboratory, Washington, DC.

EPA. 2006. SW-846 On-line, Test Methods for Evaluating Solid Waste – Physical/Chemical Methods. U.S. Environmental Protection Agency. http://www.epa.gov/epaoswer/hazwaste/test/main.htm. (Accessed January 22, 2007).

Integral. March 1, 2007. Round 2 Quality Assurance Project Plan Addendum 8: Round 3a Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, Seattle, WA.

Plumb, R.H. Jr. 1981. Procedures for Handling and Chemical Analysis of Sediment and Water Samples. Technical Report EPA/CE-81-1. U.S. Army Corps of Engineers, Vicksburg, MS.

PSEP. 1986. Puget Sound Estuary Program: Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound. Final Report. Prepared for U.S. EPA, Region 10, Office of Puget Sound, Seattle, WA and the U.S. Army Corps of Engineers, Seattle District, Seattle, WA. Tetra Tech, Inc., Bellevue, WA.

Tables

Table 3-1. Summary of Stormwater Equipment Installation Dates

Appendix	Outfall	Facility or Location	ISCO Sampler Installation	Sediment Trap Installation
A	WR-22	OSM	2/27/2007	2/22/2007
B	WR-123	Schnitzer International Slip	3/26/2007	3/26/2007
C	WR-384	Schnitzer - Riverside	3/29/2007	3/26/2007
D	WR-107	GASCO	3/6/2007	3/6/2007
E	WR-96	Arkema	3/1/2007	2/22/2007
F	WR-14	Chevron - Transportation	3/1/2007	3/1/2007
G	WR-161	Portland Shipyard	3/15/2007	3/16/2007
H	WR-4*	Sulzer Pump	2/27/2007	2/22/2007
I	WR-145/142	Gunderson	3/5/2007 (moved to WR-142 on 5/1/2007)	3/5/2007 (moved to WR-142 on 5/1/2007)
J	WR-147	Gunderson	3/5/2007	3/5/2007
K	Hwy 30	Hwy 30	3/27/2007	3/27/2007
L	OF-49	City - St. Johns Area	3/6/2007	1/31/2007
M	WR-67	Siltronic	2/28/2007	2/22/2007
N	OF-22C	City - Above Hwy 30, Forest Park Area	3/9/2007	1/30/2007
O	OF-22B	City - Doane Lake Industrial Area	3/15/2007	3/15/2007
P	OF-M1	City - Mocks Bottom	3/8/2007	3/8/2007
Q	OF-M2	City - Mocks Bottom	3/8/2007	3/8/2007
R	OF-22	City - Willbridge Industrial Area	3/9/2007	1/30/2007
S	OF-16	City - Heavy Industrial	3/8/2007	3/16/2007
T	WR-218	Albina - UPRR	4/20/2007	4/20/2007
U	St. Johns Bridge	Highway drainage	3/22/2007	3/22/2007
V	OF-18	City - Multiple Land Uses	3/15/2007	3/15/2007
W	OF-19	City - Multiple Land Uses	3/15/2007	3/15/2007

Table 3-2. Summary of Round 3A Stormwater Sampling and Programming by Site and Storm Event.

			Sample Event								
			1	2a	2b[2]	3	4	5	6-Grab	7-Grab	8
Appendix	Outfall	Facility or Location	26-Mar-07	9-Apr-07	9-Apr-07	18-Apr-07	23-Apr-07	3-May-07	21-May-07	6-Jun-07	6/10-11/2007
A	WR-22	OSM	FLOW-4	FLOW-2		FLOW-1	N/A	FLOW-1	GRAB	NC	NC
B	WR-123	Schnitzer International Slip	NI	TIME		TIME	TIME	FLOW-1	GRAB	NC	TIME
C	WR-384	Schnitzer - Riverside	NI	TIME		TIME	TIME	FLOW-1	NC	NC	TIME
D	WR-107	GASCO	FLOW-4	FLOW-2		FLOW-1	X	FLOW-1	GRAB	NC	NC
E	WR-96	Arkema	TIME	X		X	TIME	TIME	X	GRAB	TIME
F	WR-14	Chevron - Transportation	TIME	TIME		X	TIME	TIME	NC	NC	TIME
G	WR-161	Portland Shipyard	FLOW-4	FLOW-2		X	X	FLOW-1	GRAB	GRAB	FLOW-2
H	WR-4*	Sulzer Pump	FLOW-4	FLOW-2		FLOW-1	X	FLOW-1	NC	NC	NC
I	WR-145/142[1]	Gunderson	X	FLOW-2		X	X	X	GRAB	NC	TIME
J	WR-147	Gunderson	X	TIME		TIME	TIME	TIME	NC	NC	TIME
K	Hwy 30	Hwy 30	NI	FLOW-2		X	X	FLOW-1	NC	NC	TIME
L	OF-49	City - St. Johns Area	X	TIME		X	TIME	X	NC	NC	TIME
M	WR-67	Siltronic	X	FLOW-2	FLOW-2	FLOW-1	FLOW-1	FLOW-1	NC	NC	TIME
N	OF-22C	City - Above Hwy 30, Forest Park Area	X	X		FLOW-1	FLOW-1	X	NC	NC	X
O	OF-22B	City - Doane Lake Industrial Area	FLOW-4	X		NI	NI	FLOW-1	X	GRAB	X
P	OF-M1	City - Mocks Bottom	FLOW-4	FLOW-2		FLOW-1	NC	X	NC	NC	FLOW-2
Q	OF-M2	City - Mocks Bottom	X	FLOW-2	FLOW-2	X	FLOW-1	FLOW-1	NC	NC	X
R	OF-22	City - Willbridge Industrial Area	X	FLOW-2		X	X	FLOW-1	X	GRAB	FLOW-2
S	OF-16	City - Heavy Industrial	X	FLOW-2		FLOW-1	FLOW-1	FLOW-1	NC	NC	FLOW-2
T	WR-218	Albina - UPRR	NI	NI		NI	X	TIME	NC	NC	TIME
U	St. Johns Bridge	Highway drainage	FLOW-4	FLOW-2		FLOW-1	TIME	TIME	GRAB	NC	TIME
V	OF-18	City - Multiple Land Uses	FLOW-4	FLOW-2		FLOW-1	NC	FLOW-1	GRAB	NC	NC
W	OF-19	City - Multiple Land Uses	FLOW-4	FLOW-2		FLOW-1	FLOW-1	FLOW-1	NC	NC	NC

Note:

[1] Sample site WR-145 was moved to site WR-142 during the sampling period as the site became obstructed.

[2] Two separate samples with a 24 hour dry period in between were retrieved on the same day at these sites, and therefore have the same sample date but represent different storms

NC: Samples were not collected during this sample event because adequate samples had been collected from the site, or no sampling was required.

NI: Samples were not collected during this sample event because the equipment was not installed due to site access issues or equipment unavailability.

X: Sampling effort failed due to either inability to activate the sampler, equipment failure, or insufficient sample volume was collected over the interval meeting FSP criteria.

FLOW-1: Extended flow program 1 for rainfall bewween 0.2 and 0.35 inchese was enabled.

FLOW-2: Extended flow program 2 for rainfall between 0.35 and 0.50 inches was enabled.

FLOW-4: Extended flow program 4 for rainfall between 0.75 and 1.5 inches was enabled.

TIME: Time based sampling was enabled.

Table 3-3a. Storm Statistics for Storm 1 (Sample Date March 26th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of first aliquot collected by ISCO	Time of last aliquot collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4	3/24-25/2007	3/24/2007 5:00	3/25/2007 8:00	1.13	3/20/2007 15:00	3.6	3	94	3/24/2007 5:33	3/25/2007 12:38	3/26/2007 9:00
B	WR-123 Schnitzer International Slip	Terminal 4											
C	WR-384 Schnitzer - Riverside	Terminal 4											
D	WR-107 GASCO	WPCL	3/24-25/2007	3/24/2007 5:00	3/25/2007 8:00	1.13	3/20/2007 19:00	3.4	5	106	3/24/2007 6:26	3/25/2007 4:02	3/26/2007 12:25
E	WR-96 Arkema	WPCL	3/24-25/2007	3/24/2007 5:00	3/25/2007 8:00	1.13	3/20/2007 19:00	3.4	5	106	3/24/2007 5:40	3/25/2007 4:39	3/26/2007 10:30
F	WR-14 Chevron	Yeon	3/24-25/2007	3/24/2007 4:00	3/25/2007 8:00	1.17	3/20/2007 14:00	3.6	4	118	3/23/2007 21:18	3/25/2007 17:29	3/26/2007 9:00
G	WR-161 Portland Shipyard	Swan Island	3/24-25/2007	3/24/2007 4:00	3/25/2007 9:00	1.21	3/20/2007 15:00	3.5	5	124	3/24/2007 5:32	3/25/2007 0:45	3/26/2007 11:55
H	WR-4* Sulzer Pump	Yeon	3/24/2007 (1)	3/24/2007 4:00	3/25/2007 8:00	1.17	3/20/2007 14:00	3.6	4	118	3/23/2007 21:30	3/24/2007 20:07	3/26/2007 10:30
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon											
K	Hwy 30	Yeon											
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL											
N	OF-22C City	WPCL											
O	OF-22B City	WPCL	3/24-25/2007	3/24/2007 5:00	3/25/2007 8:00	1.13	3/20/2007 19:00	3.4	5	106	5/24/2007 5:32	3/27/2007 11:12	3/26/2007 12:25
P	OF-M1 City	Swan Island	3/24-25/2007	3/24/2007 4:00	3/25/2007 9:00	1.21	3/20/2007 15:00	3.5	5	124	3/23/2007 21:47	3/25/2007 8:03	3/26/2007 8:10
Q	OF-M2 City	Swan Island											
R	OF-22 City	Yeon											
S	OF-16 City	Yeon											
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL	3/24-25/2007	3/24/2007 5:00	3/25/2007 8:00	1.13	3/20/2007 19:00	3.4	5	106	3/23/2007 23:11	3/25/2007 5:55	3/26/2007 8:00
V	OF-18 City	Yeon	3/24-25/2007	3/24/2007 4:00	3/25/2007 8:00	1.17	3/20/2007 14:00	3.6	4	118	3/23/2007 21:10	3/25/2007 12:58	3/26/2007 10:10
W	OF-19 City	Yeon	3/24-25/2007	3/24/2007 4:00	3/25/2007 8:00	1.17	3/20/2007 14:00	3.6	4	118	3/23/2007 21:09	3/25/2007 12:23	3/26/2007 8:00

Note:
Shaded cell = no valid sample.
[1] Note that the sample from WR-4* is representative of only the first portion of the storm, and not the longer duration storm sampled at other locations. The first portion of the storm still meets FSP requirements for the amount of rainfall.

Table 3-3b. Storm Statistics for Storm 2a (Sample Date April 9th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	48	4/7/2007 2:37	4/8/2007 19:16	4/9/2007 9:40
B	WR-123 Schnitzer International Slip	Terminal 4	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	48	4/7/2007 2:04	4/8/2007 4:23	4/9/2007 14:10
C	WR-384 Schnitzer - Riverside	Terminal 4	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	48	4/6/2007 14:04	4/7/2007 16:23	4/9/2007 13:40
D	WR-107 GASCO	WPCL	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	47	4/7/2007 5:07	4/7/2007 20:49	4/9/2007 12:05
E	WR-96 Arkema	WPCL											
F	WR-14 Chevron	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/6/2007 11:42	4/7/2007 13:48	4/9/2007 9:30
G	WR-161 Portland Shipyard	Swan Island	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 15:00	6.5	0	58	4/7/2007 3:22	4/7/2007 14:14	4/9/2007 10:50
H	WR-4* Sulzer Pump	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:52	4/7/2007 14:58	4/9/2007 8:20
I	WR-145/142 Gunderson	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 5:11	4/7/2007 6:19	4/9/2007 11:35
J	WR-147 Gunderson	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:51	4/7/2007 15:25	4/9/2007 11:10
K	Hwy 30	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:34	4/8/2007 4:54	4/9/2007 13:20
L	OF-49 City	WPCL	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	47	4/7/2007 2:49	4/8/2007 5:09	4/9/2007 10:35
M	WR-67 Siltronic	WPCL	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	47	4/7/2007 4:51	see storm 2b	4/9/2007 8:40
N	OF-22C City	WPCL											
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 15:00	6.5	0	58	4/7/2007 2:26	4/7/2007 14:39	4/9/2007 9:45
Q	OF-M2 City	Swan Island	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 15:00	6.5	0	58	4/6/2007 20:42	see storm 2b	4/9/2007 8:45
R	OF-22 City	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:28	4/7/2007 14:03	4/9/2007 11:30
S	OF-16 City	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:22	4/7/2007 14:56	4/9/2007 14:10
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	3/31/2007 13:00	6.5	0	47	4/7/2007 23:37	4/9/2007 8:13	4/9/2007 8:20
V	OF-18 City	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/6/2007 15:31	4/8/2007 19:50	4/9/2007 14:15
W	OF-19 City	Yeon	4/7/2007	4/7/2007 2:00	4/7/2007 14:00	0.50	4/1/2007 12:00	5.6	0	52	4/7/2007 2:32	4/8/2007 17:19	4/9/2007 7:45

Note:
Shaded cell = no valid sample.

Table 3-3c. Storm Statistics for Storm 2b (Sample Date April 9th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4											
B	WR-123 Schnitzer International Slip	Terminal 4											
C	WR-384 Schnitzer - Riverside	Terminal 4											
D	WR-107 GASCO	WPCL											
E	WR-96 Arkema	WPCL											
F	WR-14 Chevron	Yeon											
G	WR-161 Portland Shipyard	Swan Island											
H	WR-4* Sulzer Pump	Yeon											
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon											
K	Hwy 30	Yeon											
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL	4/8/2007	4/8/2007 16:00	4/9/2007 0:00	0.33	4/7/2007 15:00	1.0	0	27	see storm 2a	4/9/2007 10:28	4/9/2007 8:40
N	OF-22C City	WPCL											
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island											
Q	OF-M2 City	Swan Island	4/8-9/2007	4/8/2007 15:00	4/9/2007 0:00	0.38	4/7/2007 15:00	1.0	0	31	see storm 2a	4/9/2007 2:08	4/9/2007 8:45
R	OF-22 City	Yeon											
S	OF-16 City	Yeon											
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL											
V	OF-18 City	Yeon											
W	OF-19 City	Yeon											

Note:
Shaded cell = no valid sample.

Table 3-3d. Storm Statistics for Storm 3 (Sample Date April 18th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 7:00	2.1	0	33	4/16/2007 13:03	4/16/2007 19:58	4/18/2007 13:15
B	WR-123 Schnitzer International Slip	Terminal 4	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 7:00	2.1	0	33	4/17/2007 4:17	4/16/2007 6:36	4/18/2007 12:40
C	WR-384 Schnitzer - Riverside	Terminal 4	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 7:00	2.1	0	33	4/17/2007 6:36	4/18/2007 1:11	4/18/2007 12:10
D	WR-107 GASCO	WPCL	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 4:00	2.2	0	30	4/16/2007 15:13	4/18/2007 15:49	4/18/2007 15:45
E	WR-96 Arkema	WPCL											
F	WR-14 Chevron	Yeon											
G	WR-161 Portland Shipyard	Swan Island											
H	WR-4* Sulzer Pump	Yeon	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 15:00	1.8	0	33	4/16/2007 13:18	4/18/2007 3:45	4/18/2007 8:45
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 15:00	1.8	0	33	4/16/2007 13:33	4/17/2007 20:22	4/18/2007 10:44
K	Hwy 30	Yeon											
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 4:00	2.2	0	30	4/17/2007 6:03	4/17/2007 18:56	4/18/2007 9:30
N	OF-22C City	WPCL	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 4:00	2.2	0	30	4/16/2007 12:12	4/18/2007 8:17	4/18/2007 8:55
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 8:00	2.0	0	49	4/16/2007 18:53	4/17/2007 19:27	4/18/2007 9:05
Q	OF-M2 City	Swan Island											
R	OF-22 City	Yeon											
S	OF-16 City	Yeon	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 15:00	1.8	0	33	4/16/2007 17:43	4/17/2007 17:02	4/18/2007 15:05
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 4:00	2.2	0	30	4/16/2007 11:32	4/17/2007 17:33	4/18/2007 9:35
V	OF-18 City	Yeon	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 15:00	1.8	0	33	4/16/2007 12:28	4/18/2007 7:41	4/18/2007 12:00
W	OF-19 City	Yeon	4/16-17/2007	4/16/2007 9:00	4/17/2007 19:00	1.42	4/14/2007 15:00	1.8	0	33	4/16/2007 13:11	4/18/2007 5:44	4/18/2007 11:10

Note:
Shaded cell = no valid sample.

Table 3-3e. Storm Statistics for Storm 4 (Sample Date April 23rd)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4											
B	WR-123 Schnitzer International Slip	Terminal 4	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/18/2007 22:00	2.6	0	25	4/21/2007 13:05	4/22/2007 15:24	4/23/2007 13:15
C	WR-384 Schnitzer - Riverside	Terminal 4	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/18/2007 22:00	2.6	0	25	4/21/2007 16:42	4/21/2007 23:32	4/23/2007 12:50
D	WR-107 GASCO	WPCL											
E	WR-96 Arkema	WPCL	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 3:00	2.4	0	26	4/21/2007 14:27	4/21/2007 22:42	4/23/2007 15:45
F	WR-14 Chevron	Yeon	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 15:00	1.9	0	27	4/21/2007 9:31	4/22/2007 16:01	4/23/2007 8:02
G	WR-161 Portland Shipyard	Swan Island											
H	WR-4* Sulzer Pump	Yeon											
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 15:00	1.9	0	27	4/21/2007 11:16	4/21/2007 21:22	4/23/2007 9:45
K	Hwy 30	Yeon											
L	OF-49 City	WPCL	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 3:00	2.4	0	26	4/21/2007 13:36	4/21/2007	4/23/2007 9:15
M	WR-67 Siltronic	WPCL	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 3:00	2.4	0	26	04/21/2007 15:56	04/21/2007 19:35	4/23/2007 9:40
N	OF-22C City	WPCL	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 3:00	2.4	0	26	04/21/2007 08:39	04/23/2007 01:37	4/23/2007 8:40
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island											
Q	OF-M2 City	Swan Island	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/18/2007 21:00	2.7	0	29	4/21/2007 5:59	4/21/2007 19:26	4/23/2007 8:10
R	OF-22 City	Yeon											
S	OF-16 City	Yeon	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 15:00	1.9	0	27	4/21/2007 13:34	4/21/2007 18:29	4/23/2007 13:30
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 3:00	2.4	0	26	4/21/2007 13:32	4/22/2007 10:41	4/23/2007 8:55
V	OF-18 City	Yeon											
W	OF-19 City	Yeon	4/21/2007	4/21/2007 13:00	4/21/2007 17:00	0.17	4/19/2007 15:00	1.9	0	27	04/21/2007 08:13	04/22/2007 09:35	4/23/2007 10:15

Note:
Shaded cell = no valid sample.

Table 3-3f. Storm Statistics for Storm 5 (Sample Date May 3rd)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/21/2007 18:00	10.2	0	31	5/1/2007 22:48	5/3/2007 9:18	5/3/2007 13:01
B	WR-123 Schnitzer International Slip	Terminal 4	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/21/2007 18:00	10.2	0	31	5/1/2007 8:56	5/3/2007 11:13	5/3/2007 13:52
C	WR-384 Schnitzer - Riverside	Terminal 4	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/21/2007 18:00	10.2	0	31	5/1/2007 10:38	5/3/2007 6:16	5/3/2007 14:18
D	WR-107 GASCO	WPCL	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/22/2007 12:00	9.4	0	38	5/1/2007 22:11	5/2/2007 20:13	5/3/2007 12:10
E	WR-96 Arkema	WPCL	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/22/2007 12:00	9.4	0	38	5/1/2007 10:46	5/3/2007 3:05	5/2/2007 8:38
F	WR-14 Chevron	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:33	5/3/2007 2:40	5/3/2007 10:45
G	WR-161 Portland Shipyard	Swan Island	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 14:00	9.3	0	61	5/1/2007 22:47	5/2/2007 17:43	5/3/2007 9:55
H	WR-4* Sulzer Pump	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:52	5/2/2007 14:59	5/3/2007 8:40
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:58	5/3/2007 2:59	5/3/2007 9:30
K	Hwy 30	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:46	5/2/2007 18:31	5/3/2007 12:15
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/22/2007 12:00	9.4	0	38	5/2/2007 0:50	5/2/2007 19:41	5/3/2007 11:20
N	OF-22C City	WPCL											
O	OF-22B City	WPCL	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/22/2007 12:00	9.4	0	38	5/1/2007 22:58	5/3/2007 8:09	5/3/2007
P	OF-M1 City	Swan Island											
Q	OF-M2 City	Swan Island	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 14:00	9.3	0	61	5/1/2007 10:48	5/2/2007 14:37	5/3/2007 9:00
R	OF-22 City	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:48	5/2/2007 14:13	5/3/2007 13:10
S	OF-16 City	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:46	5/2/2007 14:20	5/3/2007 11:00
T	WR-218 Albina - UPRR	Albina	5/1-2/2007	5/1/2007 22:00	5/2/2007 18:00	0.83	4/21/2007 21:00	10.0	0	42	5/1/2007 22:47	5/2/2007 19:45	5/3/2007 8:15
U	St. Johns Bridge - Highway Drainage	WPCL	5/1-2/2007	5/1/2007 22:00	5/2/2007 17:00	0.79	4/22/2007 12:00	9.4	0	38	5/1/2007 22:42	5/2/2007 11:51	5/3/2007 7:40
V	OF-18 City	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 22:53	5/3/2007 7:54	5/3/2007
W	OF-19 City	Yeon	5/1-2/2007	5/1/2007 22:00	5/2/2007 21:00	0.96	4/22/2007 6:00	9.7	0	56	5/1/2007 8:24	5/2/2007 13:04	5/3/2007 10:20

Note:
Shaded cell = no valid sample.

Table 3-3g. Storm Statistics for Storm 6 (Sample Date May 21st)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	1	23	5/20/2007 16:57	5/20/2007 17:08	5/21/2007 15:00
B	WR-123 Schnitzer International Slip	Terminal 4	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	1	23	5/20/2007 15:51	5/20/2007 16:02	5/21/2007 14:00
C	WR-384 Schnitzer - Riverside	Terminal 4											
D	WR-107 GASCO	WPCL	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	0	26	5/20/2007 17:24	5/20/2007 17:35	5/21/2007 10:30
E	WR-96 Arkema	WPCL											
F	WR-14 Chevron	Yeon											
G	WR-161 Portland Shipyard	Swan Island	5/21/2007	5/21/2007 12:00	5/21/2007 15:00	0.13	5/20/2007 10:00	1.1	18	7	5/21/2007 10:58	5/21/2007 10:58	5/21/2007 15:00
H	WR-4* Sulzer Pump	Yeon											
I	WR-145/142 Gunderson	Yeon	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	1	24	5/20/2007 17:09	5/20/2007 17:21	5/21/2007 11:10
J	WR-147 Gunderson	Yeon											
K	Hwy 30	Yeon											
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL											
N	OF-22C City	WPCL											
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island											
Q	OF-M2 City	Swan Island											
R	OF-22 City	Yeon											
S	OF-16 City	Yeon											
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	0	23	5/20/2007 16:36	5/20/2007 16:55	5/21/2007 9:55
V	OF-18 City	Yeon	5/20/2007	5/20/2007 5:00	5/20/2007 18:00	0.54	5/19/2007 0:00	1.2	1	24	5/20/2007 16:45	5/20/2007 16:56	5/21/2007 12:00
W	OF-19 City	Yeon											

Note:
*** Flowlink was used to examine data on a larger scale hydrograph
Shaded cell = no valid sample.

Table 3-3h. Storm Statistics for Storm 7 (Sample Date June 5th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 hours before storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4											
B	WR-123 Schnitzer International Slip	Terminal 4											
C	WR-384 Schnitzer - Riverside	Terminal 4											
D	WR-107 GASCO	WPCL											
E	WR-96 Arkema	WPCL	6/5/2007	6/5/2007 7:00	6/5/2007 19:00	0.50	5/23/2007 20:00	12.5	1	23	6/5/2007 7:47	6/5/2007 7:58	6/5/2007 9:40
F	WR-14 Chevron	Yeon											
G	WR-161 Portland Shipyard	Swan Island	6/5/2007	6/5/2007 7:00	6/5/2007 17:00	0.42	5/23/2007 20:00	12.5	0	15	6/5/2007 7:30	6/5/2007 7:41	6/5/2007 14:55
H	WR-4* Sulzer Pump	Yeon											
I	WR-145/142 Gunderson	Yeon											
J	WR-147 Gunderson	Yeon											
K	Hwy 30	Yeon											
L	OF-49 City	WPCL											
M	WR-67 Siltronic	WPCL											
N	OF-22C City	WPCL											
O	OF-22B City	WPCL	6/5/2007	6/5/2007 7:00	6/5/2007 19:00	0.50	5/23/2007 20:00	12.5	1	23	6/5/2007 7:30	6/5/2007 7:41	6/5/2007 10:30
P	OF-M1 City	Swan Island											
Q	OF-M2 City	Swan Island											
R	OF-22 City	Yeon	6/5/2007	6/5/2007 7:00	6/5/2007 18:00	0.46	5/23/2007 20:00	12.5	0	18	6/5/2007 7:33	6/5/2007 7:44	6/5/2007
S	OF-16 City	Yeon											
T	WR-218 Albina - UPRR	Albina											
U	St. Johns Bridge - Highway Drainage	WPCL											
V	OF-18 City	Yeon											
W	OF-19 City	Yeon											

Note:

*** Flowlink was used to examine data on a larger scale hydrograph

Shaded cell = no valid sample.

Table 3-3i. Storm Statistics for Storm 8 (Sample Date June 10th)

Appendix	Site	Rain Gage	Dates of Rainfall	Time of First Measurable Rain	Time of Last Measurable Rain	Duration of Rain (days)	Date of Previous Rainfall (Greater than 0.10 inch)	Antecedent Dry Period (days)	Rain in 24 Hours Before Storm (1/100 in)	Rainfall During Storm (1/100 in)	Time of First Aliquot Collected by ISCO	Time of Last Aliquot Collected by ISCO	Sample Retrieval Date and Time
A	WR-22 OSM	Terminal 4											
B	WR-123 Schnitzer International Slip	Terminal 4	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 17:00	1.7	0	29	6/9/2007 10:04	6/9/2007 21:18	6/11/2007 9:15
C	WR-384 Schnitzer - Riverside	Terminal 4	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 17:00	1.7	0	29	6/9/2007 14:07	6/9/2007 18:57	6/11/2007 9:40
D	WR-107 GASCO	WPCL											
E	WR-96 Arkema	WPCL	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 7:00	2.1	0	39	6/9/2007 13:08	6/9/2007 18:53	6/10/2007 12:15
F	WR-14 Chevron	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 9:46	6/9/2007 22:56	6/10/2007 13:26
G	WR-161 Portland Shipyard	Swan Island	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 8:00	2.0	0	31	6/9/2007 10:49	6/9/2007 16:33	6/10/2007 11:40
H	WR-4* Sulzer Pump	Yeon											
I	WR-145/142 Gunderson	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 12:05	6/9/2007 19:50	6/10/2007 10:00
J	WR-147 Gunderson	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 11:11	6/9/2007 22:41	6/10/2007 11:45
K	Hwy 30	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 10:39	6/10/2007 4:23	6/10/2007 11:45
L	OF-49 City	WPCL	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 7:00	2.1	0	39	6/9/2007 12:01	6/9/2007 17:06	6/10/2007 16:10
M	WR-67 Siltronic	WPCL	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 7:00	2.1	0	39	6/9/2007 12:15	6/10/2007 7:59	6/10/2007 14:46
N	OF-22C City	WPCL											
O	OF-22B City	WPCL											
P	OF-M1 City	Swan Island	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 8:00	2.0	0	31	6/9/2007 10:20	6/10/2007 6:37	6/10/2007 12:10
Q	OF-M2 City	Swan Island											
R	OF-22 City	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 10:22	6/9/2007 21:42	6/10/2007 15:35
S	OF-16 City	Yeon	6/9/2007	6/9/2007 10:00	6/9/2007 16:00	0.25	6/7/2007 6:00	2.2	0	30	6/9/2007 10:14	6/9/2007 16:51	6/10/2007 14:30
T	WR-218 Albina - UPRR	Albina	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 8:00	2.0	0	28	6/9/2007 10:52	6/9/2007 17:23	6/10/2007 12:41
U	St. Johns Bridge - Highway Drainage	WPCL	6/9/2007	6/9/2007 9:00	6/9/2007 16:00	0.29	6/7/2007 7:00	2.1	0	39	6/9/2007 9:52	6/9/2007 23:01	6/10/2007 12:55
V	OF-18 City	Yeon											
W	OF-19 City	Yeon											

Note:
Shaded cell = no valid sample.

Table 3-4. Summary of Sediment Trap Inspections and Removals

Appendix	Outfall(s)	Facility or Location	Installation Date	1st Inspection			2nd Inspection			3rd Inspection		
				Date	% Full	Notes	Date	% Full	Notes	Date	% Full	Notes
A	WR-22	OSM	2/22/2007	4/19/2007	7/8"	Brown, rust colored sediment	5/19/2007	1-1.25"	Brown, rust-colored sediment			
B	WR-123	Schnitzer International Slip	3/26/2007	4/30/2007	1/8"	Removed, took pictures, and reinstalled	23-May	1/4-1/2"	very loose flocculent sediment, suspended materials			
C	WR-384	Schnitzer - Riverside	3/26/2007	4/30/2007	1/8"	Removed, took pictures, and reinstalled	5/23/2007	trace	Loose flocculated sediment			
D	WR-107	GASCO	3/6/2007	4/4/2007	1/8"	Removed, took pictures, and reinstalled	5/2/2007	5/8"	Loose flocculated sediment			
E	WR-96	Arkema	2/22/2007	3/26/2007	very little	lots of sediment on outside of jars, removed, took pictures and reinstalled	5/1/2007	very little	Caps were left on from weir installation on 3/26/2007	6/5/2007	Trace	Loose, Flocculent Sediment
F	WR-14	Chevron - Transportation	3/1/2007	4/4/2007	1/8"	Removed, took pictures, and reinstalled	5/2/2007	1/2"	Loose flocculated sediment			
G	WR-161	Portland Shipyard (Cascade General Site)	3/16/2007	4/19/2007	1/8"	Removed, took pictures, and reinstalled	5/21/2007	trace	Flocculent sediment			
H	WR-4*	Sulzer Pump	2/22/2007	4/4/2007	1/8"	Removed, took pictures, and reinstalled	5/2/2007	1/8"	Loose flocculated sediment			
I	WR-142	Gunderson	5/1/2007									
I	WR-145	Gunderson	3/5/2007	4/4/2007	1/8"	Removed, took pictures, and reinstalled	5/1/2007	1/8"	Removed and Archived, now at WR-142			
J	WR-147	Gunderson	3/5/2007	4/4/2007	1/8"	Removed, took pictures, and reinstalled	5/9/2007	1/4"-1/2"	loose sediment			
K	HWY 30	Hwy 30	3/27/2007	5/3/2007	3/16"	loose sediment	23-May	1/4"	Looce, flocculent, organic sediment			
L	OF-49	City - St. Johns Area	1/31/2007	3/6/2007	EMPTY	NEED TO MODIFY because water does not get above bottle opening	4/4/2007	1/4"	Removed, took pictures, and reinstalled.	5/8/2007	Trace	Installed weir so water over-tops bottles
M	WR-67	Siltronic	2/22/2007	4/11/2007	trace	Removed, took pictures, and reinstalled	5/11/3007	trace	Loose flocculated sediment	6/6/2007	Trace	Loose, flocculent organic sediment
N	OF-22C	City - Above Hwy 30, Forest Park Area	1/30/2007	3/7/2007	1/8"	Removed, took pictures, and reinstalled	4/4/2007	1/3"	Removed, took pictures, and reinstalled	5/16/2007	1/2-5/8"	granular, solid sediment
O	OF-22B	City - Doane Lake Industrial Area	3/15/2007	4/30/2007	1/4"	Some organics, loose sediment	5/21/2007	trace	Black, Loose, flocculent, odorous			

Table 3-4. Summary of Sediment Trap Inspections and Removals

Appendix	Outfall(s)	Facility or Location	Installation Date	1st Inspection			2nd Inspection			3rd Inspection		
				Date	% Full	Notes	Date	% Full	Notes	Date	% Full	Notes
P	OF-M1	City - Mocks Bottom Industrial Area	3/8/2007	4/4/2007	trace	Rust colored Sediment	4/20/2007	1/4"	Very loose, rust colored, installed weir (4/20)	5/15/2007	1.5"-1.6"	Very loose flocculent Sediment, cloudy rust color
Q	OF-M2	City - Mocks Bottom Industrial Area	3/8/2007	4/4/2007	trace	leaves stuck around top of bottle	4/23/2007	1/4"	Very loose gray sediment, weir installed (4/23/2007)	5/15/2007	1.9"-2"	Very loose flocculent Sediment, cloudy rust color
R	OF-22	City - Willbridge Industrial Area	1/30/2007	4/5/2007	1/4"	This sample will be segregated due to hydrocarbon leak into pipe	5/3/2007	1/4"	This sample was archived for possible segregation due to a mineral oil spill	6/5/2007	Trace	Trace amounts of loose flocculent sediment
S	OF-16	City - Heavy Industrial	3/16/2007	3/27/2007	EMPTY	Sediment Traps Damaged by Falling ISCO and Removed, trace sediment	5/8/2007	1/2", 5/8"	since replaced on 3/27, loose sediment			
T	WR-218	Albina - UPRR	4/20/2007	5/22/2007	trace, 5/8"	Loose Flocculent sediment, one bottle had significantly more sediment	6/20/2007					
U	St. Johns Bridge	Under St Johns bridge	3/22/2007	4/30/2007	1/4"	4 inches of sediment and grit in pipe, but very little in bottle	22-May	1/4-3/4"	Loose, Flocculent, Organic Sediment			
V	OF-18	City-Multiple Land Uses	3/15/2007	4/30/2007	1/8"	Removed, took pictures, and reinstalled	22-May	1/2"	Loose, Flocculent, Organic Sediment			
W	OF-19	City - Multiple Land Uses	3/15/2007	4/11/2007	1/4"	Removed, took pictures, and reinstalled	5/15/2007	3/8-5/8"	Loose flocculated sediment			

* As discussed in Section 6.3, sediment traps with more than trace sediment were removed and archived at the beginning of June, with new sediment trap bottles deployed for another month.

Table 3-4. Summary of Sediment Trap Inspections and Removals

Appendix	Outfall(s)	Facility or Location	Installation Date	Beginning of June Removal and Archive*			FINAL Removal		
				Date	%Full	Notes	Date	% Full	Notes
A	WR-22	OSM	2/22/2007	5/23/2007	1.25"	Loose, flocculent sediment	XXX	XXX	XXX
B	WR-123	Schnitzer International Slip	3/26/2007	5/23/2007	1/4-1/2"	very loose flocculent sediment, suspended materials	6/30/2007	1/8 & 1/4"	Very flocculent
C	WR-384	Schnitzer - Riverside	3/26/2007				7/3/2007	1/8"	Very flocculent
D	WR-107	GASCO	3/6/2007	5/23/2007	1/2"	Loose, Flocculent sediment, green algae on outside of bottles	7/2/2007	Trace	Catch basin sample
E	WR-96	Arkema	2/22/2007				7/3/2007	Trace	
F	WR-14	Chevron - Transportation	3/1/2007	5/23/2007	1/4"	Black, loose sediment	7/3/2007	Trace	Catch basin sample
G	WR-161	Portland Shipyard (Cascade General Site)	3/16/2007				7/3/2007	5/8"	Very unconsolidated bottom
H	WR-4*	Sulzer Pump	2/22/2007	5/23/2007	1/8-1/4"	Flocculent, Organic Sediment	7/2/2007	Trace	Catch basin sample
I	WR-142	Gunderson	5/1/2007				7/3/2007	Trace	
I	WR-145	Gunderson	3/5/2007	5/1/2007	1/8"	Removed, Archived, Sed traps now in WR 142	XXX	XXX	XXX
J	WR-147	Gunderson	3/5/2007	5/23/2007	3/8"	Loose, Flocculent sediment	7/3/2007	Trace	
K	HWY 30	Hwy 30	3/27/2007	5/23/2007	1/4"	Looce, flocculent, organic sediment	7/3/2007	Trace	
L	OF-49	City - St. Johns Area	1/31/2007	6/6/2007	Trace	NOT REMOVED only trace flocculent sediment	7/3/2007	Trace	Caps in place from previous inspection
M	WR-67	Siltronic	2/22/2007				7/2/2007	3/16, 1/4, trace, 1/8"	Loose, flocculent
N	OF-22C	City - Above Hwy 30, Forest Park Area	1/30/2007	5/23/2007	1/2"	Firm, slanted deposition because of mounting.	7/2/2007	0	Dry, no evidence of water overtopping.
O	OF-22B	City - Doane Lake Industrial Area	3/15/2007				7/2/2007	1/4 & 7/16"	Flocculent

Table 3-4. Summary of Sediment Trap Inspections and Removals

Appendix	Outfall(s)	Facility or Location	Installation Date	Beginning of June Removal and Archive*			FINAL Removal		
				Date	%Full	Notes	Date	% Full	Notes
P	OF-M1	City - Mocks Bottom Industrial Area	3/8/2007	6/6/2007	1 3/4-1 7/8"	VERY loose flocculent sediment.	XXX	XXX	XXX
Q	OF-M2	City - Mocks Bottom Industrial Area	3/8/2007	6/6/2007	1 7/8 - 2"	VERY loose flocculent sediment.	XXX	XXX	XXX
R	OF-22	City - Willbridge Industrial Area	1/30/2007				7/2/2007	1/4 & 3/8"	Loose, flocculent
S	OF-16	City - Heavy Industrial	3/16/2007	5/22/2007	3/8-5/8"	Loose, Flocculent, Organic Sediment	7/2/2007	1/4"	Loose, flocculent
T	WR-218	Albina - UPRR	4/20/2007				7/3/2007	Trace, 9/16"	Loose, flocculent
U	St. Johns Bridge	Under St Johns bridge	3/22/2007	5/22/2007	1/4-3/4"	Loose, Flocculent, Organic Sediment	7/2/2007	3/8 & 1/4 "	Loose, flocculent
V	OF-18	City-Multiple Land Uses	3/15/2007	5/22/2007	1/2"	Loose, Flocculent, Organic Sediment	7/2/2007	1/4 & 7/16"	Loose, flocculent
W	OF-19	City - Multiple Land Uses	3/15/2007	5/22/2007	3/8-5/8"	Loose, Flocculent, Organic Sediment	7/2/2007	3/16, 1/4, 1/8, 1/8"	Loose, flocculent. Plastic and organic debris over all (4) bottles.

* As discussed in Section 6.3, sediment traps with more than trace sediment were removed and archived at the beginning of June, with new sediment trap bottles deployed for another month.

Table 4-1. Summary of Sample Retrieval Times.

			Sample Event						
			1	2a	2b	3	4	5	8
Appendix	Outfall	Facility or Location	26-Mar-07	9-Apr-07	9-Apr-07	18-Apr-07	23-Apr-07	3-May-07	6/10-11/2007
A	WR-22	OSM	OK	>24	--	OK	--	OK	--
B	WR-123	Schnitzer International Slip	--	>24	--	OK	>24	OK	>24
C	WR-384	Schnitzer - Riverside	--	>24	--	OK	>24	OK	>24
D	WR-107	GASCO	OK	>24	--	OK	--	OK	--
E	WR-96	Arkema	OK	--	--	--	>24	OK	OK
F	WR-14	Chevron - Transportation	OK	>24	--	--	>24	OK	OK
G	WR-161	Portland Shipyard	OK	>24	--	--	--	OK	OK
H	WR-4*	Sulzer Pump	>24	>24	--	OK	--	OK	--
I	WR-145/142	Gunderson	--	>24	--	--	--	--	OK
J	WR-147	Gunderson	--	>24	--	OK	>24	OK	OK
K	Hwy 30	Hwy 30	--	>24	--	--	--	OK	OK
L	OF-49	City - St. Johns Area	--	>24	--	--	>24	--	OK
M	WR-67	Siltronic	--	>24	OK	OK	>24	OK	OK
N	OF-22C	City - Above Hwy 30, Forest Park Area	--	--	--	OK	>24	--	--
O	OF-22B	City - Doane Lake Industrial Area	OK	--	--	--	--	OK	--
P	OF-M1	City - Mocks Bottom	OK	>24	--	OK	--	--	OK
Q	OF-M2	City - Mocks Bottom	--	>24	OK	--	>24	OK	--
R	OF-22	City - Willbridge Industrial Area	--	>24	--	--	--	OK	OK
S	OF-16	City - Heavy Industrial	--	>24	--	OK	>24	OK	OK
T	WR-218	Albina - UPRR	--	--	--	--	--	OK	OK
U	St. Johns Bridge	Highway drainage	OK	>24	--	OK	>24	OK	OK
V	OF-18	City - Multiple Land Uses	OK	>24	--	OK	--	OK	--
W	OF-19	City - Multiple Land Uses	OK	>24	--	OK	>24	OK	--

Note:
OK - Sample was retrieved within 24 hours of the end of the sampling event
>24 - Sample was retrieved over 24 hours after the completion of the sampling event
-- - No sample was retreived

Table 4-2. Summary of Round 3A Stormwater Composite Samples Collected by Site and Storm Event.

Appendix	Outfall(s)	Facility or Location	Station ID	Sample Event ID	Date Retrieved	TSS	TOC	DOC (filtered)	Total Metals	Diss. Metals (filtered)	PAHs	Phthalates	PCB Congeners	Herbicides	Organo-chlorine Pesticides
A	WR-22	OSM	WR-22	LW3-STW-CW20-WR22	9-Apr-07	X	X	NC	X	NC	X	X	X	X	--
			WR-22	LW3-STW-CW30-WR22	18-Apr-07	X	X	X	X	X	X	X	X	X	--
			WR-22	LW3-STW-CW40-WR22	3-May-07	X	X	X	X	X	NC	NC	NC	NC	--
			WR-22	LW3-STW-CW10-WR22	26-Mar-07	X	X	X	X	X	X	X	X	X	--
B	WR-123	Schnitzer International Slip	WR-123	LW3-STW-CW10-WR123	9-Apr-07	X	X	NC	X	NC	X	NC	NA	X	--
			WR-123	LW3-STW-CW20-WR123	18-Apr-07	X	X	X	X	X	X	X	X	NC	--
			WR-123	LW3-STW-CW30-WR123	23-Apr-07	X	X	X	X	NC	X	X	NC	NC	--
			WR-123	LW3-STW-CW40-WR123	3-May-07	X	X	X	X	X	NC	X	X	X	--
			WR-123	LW3-STW-CW50-WR123	11-Jun-07	X	X	X	NC	NC	NC	NC	X	X	--
C	WR-384	Schnitzer - Riverside	WR-384	LW3-STW-CW10-WR384	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			WR-384	LW3-STW-CW20-WR384	18-Apr-07	X	X	X	X	X	X	--	X	NC	--
			WR-384	LW3-STW-CW30-WR384	23-Apr-07	X	X	X	X	NC	X	--	NC	NC	--
			WR-384	LW3-STW-CW40-WR384	3-May-07	X	X	X	X	X	X	--	X	X	--
			WR-384	LW3-STW-CW50-WR384	11-Jun-07	X	X	X	NC	NC	NC	--	NC	X	--
D	WR-107	GASCO	WR-107	LW3-STW-CW10-WR107	26-Mar-07	X	X	X	X	X	X	--	NC	NC	--
			WR-107	LW3-STW-CW20-WR107	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			WR-107	LW3-STW-CW30-WR107	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			WR-107	LW3-STW-CW40-WR107	3-May-07	X	X	X	X	X	NC	--	X	X	--
E	WR-96	Arkema	WR-96	LW3-STW-CW10-WR96	26-Mar-07	X	X	X	X	X	X	X	NC	NC	X
			WR-96	LW3-STW-CW20-WR96	23-Apr-07	X	X	X	X	NC	X	NC	NC	NC	X
			WR-96	LW3-STW-CW30-WR96	3-May-07	X	X	X	X	X	X	X	X	NC	X
			WR-96	LW3-STW-CW40-WR96	10-Jun-07	X	X	X	X	X	NC	X	X	X	NC
F	WR-14	Chevron - Transportation	WR-14	LW3-STW-CW10-WR14	26-Mar-07	X	X	X	X	X	X	--	X	X	--
			WR-14	LW3-STW-CW20-WR14	9-Apr-07	X	X	NC	X	NC	X	--	NC	NC	--
			WR-14	LW3-STW-CW30-WR14	23-Apr-07	X	X	X	X	NC	X	--	X	NC	--
			WR-14	LW3-STW-CW40-WR14	3-May-07	X	X	X	X	X	NC	--	X	X	--
			WR-14	LW3-STW-CW50-WR14	10-Jun-07	X	X	X	X	X	NC	--	NC	X	--
G	WR-161	Portland Shipyard	WR-161	LW3-STW-CW10-WR161	26-Mar-07	X	X	X	X	X	X	NC	NC	NC	--
			WR-161	LW3-STW-CW20-WR161	9-Apr-07	X	X	NC	X	NC	X	X	X	X	--
			WR-161	LW3-STW-CW30-WR161	3-May-07	X	X	X	X	X	X	X	X	X	--
			WR-161	LW3-STW-CW40-WR161	10-Jun-07	X	X	X	X	X	NC	X	X	X	--
H	WR-4*	Sulzer Pump	WR-4*	LW3-STW-CW10-WR4	26-Mar-07	X	X	X	X	X	X	--	X	X	--
			WR-4*	LW3-STW-CW20-WR4	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			WR-4*	LW3-STW-CW30-WR4	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			WR-4*	LW3-STW-CW40-WR4	3-May-07	X	X	X	X	X	NC	--	NC	NC	--
I	WR-145	Gunderson	WR-145	LW3-STW-CW10-WR145	9-Apr-07	X	X	NC	X	NC	X	NC	NC	NC	--
I	WR-142*	Gunderson	WR-142	LW3-STW-CW10-WR142	10-Jun-07	X	X	X	X	X	X	X	X	X	--

Table 4-2. Summary of Round 3A Stormwater Composite Samples Collected by Site and Storm Event.

Appendix	Outfall(s)	Facility or Location	Station ID	Sample Event ID	Date Retrieved	TSS	TOC	DOC (filtered)	Total Metals	Diss. Metals (filtered)	PAHs	Phthalates	PCB Congeners	Herbicides	Organo-chlorine Pesticides
J	WR-147	Gunderson	WR-147	LW3-STW-CW10-WR147	9-Apr-07	X	X	NC	X	NC	X	X	X	NC	--
			WR-147	LW3-STW-CW20-WR147	18-Apr-07	X	X	X	X	X	X	X	X	NC	--
			WR-147	LW3-STW-CW30-WR147	23-Apr-07	X	X	X	X	NC	X	X	X	NC	--
			WR-147	LW3-STW-CW40-WR147	3-May-07	X	X	X	X	X	NC	NC	NC	X	--
			WR-147	LW3-STW-CW50-WR147	10-Jun-07	X	X	X	X	X	NC	NC	NC	X	--
K	Hwy 30	Hwy 30	H30	LW3-STW-CW10-H30	9-Apr-07	X	X	NC	X	NC	X	--	NA	X	--
			H30	LW3-STW-CW20-H30	3-May-07	X	X	X	X	X	X	--	X	X	--
			H30	LW3-STW-CW30-H30	10-Jun-07	X	X	X	X	X	X	--	NC	NC	--
L	OF-49	City - St. Johns Area	OF-49	LW3-STW-CW10-OF49	9-Apr-07	X	X	NC	X	NC	X	X	X	X	--
			OF-49	LW3-STW-CW20-OF49	23-Apr-07	X	X	X	X	NC	X	X	X	X	--
			OF-49	LW3-STW-CW30-OF49	9-Jun-07	X	X	X	X	X	X	NC	NC	NC	--
M	WR-67	Siltronic	WR-67	LW3-STW-CW10-WR67	9-Apr-07	X	X	NC	X	NC	X	--	NA	X	--
			WR-67	LW3-STW-CW20-WR67	9-Apr-07	X	X	X	X	X	X	--	X	NC	--
			WR-67	LW3-STW-CW30-WR67	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			WR-67	LW3-STW-CW40-WR67	23-Apr-07	X	X	X	NA	NC	NC	--	X	NC	--
			WR-67	LW3-STW-CW50-WR67	3-May-07	X	X	X	X	X	NC	--	NC	NC	--
			WR-67	LW3-STW-CW60-WR67	10-Jun-07	X	X	X	X	X	X	--	X	X	--
N	OF-22C	City - Above Hwy 30, Forest Park Area	OF-22C	LW3-STW-CW10-OF22C	18-Apr-07	X	X	X	X	X	X	X	X	X	--
			OF-22C	LW3-STW-CW20-OF22C	23-Apr-07	X	X	X	X	NC	X	X	X	X	--
O	OF-22B	City - Doane Lake Industrial Area	OF-22B	LW3-STW-CW10-OF22B	26-Mar-07	X	X	X	X	X	X	--	X	X	X
			OF-22B	LW3-STW-CW20-OF22B	3-May-07	X	X	X	X	X	X	--	X	X	X
P	OF-M1	City - Mocks Bottom	OF-M1	LW3-STW-CW10-OFM1	26-Mar-07	X	X	X	X	X	X	--	X	X	--
			OF-M1	LW3-STW-CW20-OFM1	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			OF-M1	LW3-STW-CW30-OFM1	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			OF-M1	LW3-STW-CW40-OFM1	10-Jun-07	X	X	X	X	X	NC	--	NC	NC	--
Q	OF-M2	City - Mocks Bottom	OF-M2	LW3-STW-CW10-OFM2	9-Apr-07	X	X	NC	X	NC	X	X	X	X	--
			OF-M2	LW3-STW-CW20-OFM2	9-Apr-07	X	X	X	X	X	X	X	X	NC	--
			OF-M2	LW3-STW-CW30-OFM2	23-Apr-07	X	X	X	X	NC	X	X	X	X	--
			OF-M2	LW3-STW-CW40-OFM2	3-May-07	X	X	X	X	X	X	X	X	X	--
R	OF-22	City - Willbridge Industrial Area	OF-22	LW3-STW-CW10-OF22	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			OF-22	LW3-STW-CW20-OF22	3-May-07	X	X	X	X	X	X	--	X	X	--
			OF-22	LW3-STW-CW30-OF22	9-Jun-07	X	X	X	X	X	X	--	X	X	--
S	OF-16	City - Heavy Industrial	OF-16	LW3-STW-CW10-OF16	9-Apr-07	X	X	NC	X	NC	X	--	X	X	--
			OF-16	LW3-STW-CW20-OF16	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			OF-16	LW3-STW-CW30-OF16	23-Apr-07	X	X	X	X	NC	X	--	X	X	--
			OF-16	LW3-STW-CW40-OF16	3-May-07	X	X	X	X	X	NC	--	NC	NC	--
			OF-16	LW3-STW-CW50-OF16	10-Jun-07	X	NC	NC	X	X	NC	--	NC	NC	--

Table 4-2. Summary of Round 3A Stormwater Composite Samples Collected by Site and Storm Event.

Appendix	Outfall(s)	Facility or Location	Station ID	Sample Event ID	Date Retrieved	TSS	TOC	DOC (filtered)	Total Metals	Diss. Metals (filtered)	PAHs	Phthalates	PCB Congeners	Herbicides	Organo-chlorine Pesticides
T	WR-218	Albina - UPRR	WR-218	LW3-STW-CW20-WR218	10-Jun-07	X	X	X	X	X	X	--	X	NC	--
			WR-218	LW3-STW-CW10-WR218	3-May-07	X	X	X	X	X	X	--	X	X	--
U	St. Johns Bridge	Highway drainage	SJB	LW3-STW-CW10-SJB	26-Mar-07	X	X	X	X	X	X	NC	NC	NC	--
			SJB	LW3-STW-CW20-SJB	9-Apr-07	X	X	NC	X	NC	X	X	NC	NC	--
			SJB	LW3-STW-CW30-SJB	18-Apr-07	X	X	X	X	X	X	X	X	NC	--
			SJB	LW3-STW-CW40-SJB	23-Apr-07	X	X	X	NA	NC	NC	X	X	X	--
			SJB	LW3-STW-CW50-SJB	3-May-07	X	X	X	X	X	NC	NC	X	X	--
			SJB	LW3-STW-CW60-SJB	10-Jun-07	X	X	X	NC	NC	NC	NC	NC	X	--
V	OF-18	City - Multiple Land Uses	OF-18	LW3-STW-CW10-OF18	26-Mar-07	X	X	X	X	X	X	X	X	X	--
			OF-18	LW3-STW-CW20-OF18	9-Apr-07	X	X	NC	X	NC	X	X	X	X	--
			OF-18	LW3-STW-CW30-OF18	18-Apr-07	X	X	X	X	X	X	X	X	X	--
			OF-18	LW3-STW-CW40-OF18	3-May-07	X	X	X	X	X	NC	NC	NC	NC	--
W	OF-19	City - Multiple Land Uses	OF-19	LW3-STW-CW10-OF19	26-Mar-07	X	X	X	X	X	X	--	X	X	--
			OF-19	LW3-STW-CW20-OF19	9-Apr-07	X	X	NC	X	NC	X	--	NA	X	--
			OF-19	LW3-STW-CW30-OF19	18-Apr-07	X	X	X	X	X	X	--	X	X	--
			OF-19	LW3-STW-CW40-OF19	23-Apr-07	X	X	X	NA	NC	NC	--	X	X	--
			OF-19	LW3-STW-CW50-OF19	3-May-07	X	X	X	X	X	NC	--	NC	NC	--

Notes:

NC = Parameter not collected due logistical issues or beccause the sampling for this parameter was complete.
NA= Samples collected but not analyzed.
* Station WR-145 moved WR-142 after first storm event.
-- = The FSP does not require analysis of this parameter for this station.

Table 4-3. Summary of Field QC Samples for Round 3A Stormwater Composite Samples.

Sample Event ID	Station	Date Collected	QC Sample Type	Analyses									
				TSS	TOC	DOC (filtered)	Total Metals	Diss. Metals (filtered)	PAHs	Phthalates	PCB Congeners	Herbicides	Organo-chlorine Pesticides
LW3-STW-WB01	NA	6-Mar-07	Rinsate blank of ISCO tubing		X		X		X	X	X	X	X
LW3-STW-CW10-RB04	NA	16-Mar-07	Rinsate blank of entire composite process		X		X	X	X	X	X	X	X
LW3-STW-CWRB02	NA	16-Mar-07	Rinsate blank of ISCO tubing and sample arm				X						
LW3-STW-CWRB03	NA	16-Mar-07	Rinsate blank of ISCO tubing, sample arm, and sample bottles				X						
LW3-STW-CW10-OF18-2	OF-18	26-Mar-07	field duplicate			X	X	X	X		X		
LW3-STW-CW10-OFM1-2	OF-M1	26-Mar-07	field duplicate	X	X								
LW3-STW-CW10-WR22-2	WR-22	26-Mar-07	field duplicate							X			
LW3-STW-CW10-OF22B-2	OF-22B	27-Mar-07	field duplicate										X
LW3-STW-CW10-WR67-2	WR-67	9-Apr-07	field duplicate								X		
LW3-STW-CW20-OF19-2	OF-19	9-Apr-07	field duplicate	X	X		X		X				
LW3-STW-CW20-WR161-2	WR-161	9-Apr-07	field duplicate							X		X	
LW3-STW-CW10-OF22C-2	OF-22C	18-Apr-07	field duplicate						X	X	X		
LW3-STW-CW30-OF18-2	OF-18	18-Apr-07	field duplicate									X	
LW3-STW-CW30-WR4-2	WR-4*	18-Apr-07	field duplicate	X	X	X	X	X					
LW3-STW-CW20-OF22C-2	OF-22C	23-Apr-07	field duplicate			X			X	X	X	X	
LW3-STW-CW20-OF49-2	OF-49	23-Apr-07	field duplicate	X	X								
LW3-STW-CW30-OFM2-2	OF-M2	23-Apr-07	field duplicate			X							
LW3-STW-CW20-OF22B-2	OF-22B	3-May-07	field duplicate										X
LW3-STW-CW40-OFM2-2	OF-M2	3-May-07	field duplicate						X	X	X	X	
LW3-STW-CW40-WR4-2	WR-4*	3-May-07	field duplicate	X	X	X	X	X					
LW3-STW-CW10-W900	NA	26-Mar-07	Field blank of WR-96, WR-*4, OF-19, WR-107	X	X	X	X	X	X	X	X	X	X
LW3-STW-CW20-W901	NA	9-Apr-07	Field blank of WR-4*, WR-161, WR-145. OF-16	X	X	X	X	X	X	X		X	X
LW3-STW-CW30-W902	NA	19-Apr-07	Field blank of WR-67, WR-4, OF-16, WR-147	X	X	X	X	X	X	X	X	X	X
LW3-STW-CW40-W903	NA	23-Apr-07	Field blank of WR-96, WR-67, OF-16, WR-147	X	X	X	X		X	X	X	X	X
LW3-STW-CW50-W905	NA	3-May-07	Field blank of WR-4*, WR-96, OF-16, WR-161	X	X		X		X	X	X	X	X
LW3-STW-CW50-W906	NA	11-Jun-07	Field blank of OF-16, WR-147, WR-218, WR-96	X	X	X	X	X	X	X	X	X	X

Table 4-4. Summary of Deviations for Stormwater Sampling Program.

Sampling Activity	Deviations	Samples Affected	Impact of Deviation or Modification	Date of Stormwater Technical Meeting or Email where discussed.*
Decontamination				
Decontamination of ISCO collection vessels and glass carboys	Due to the large quantity of containers, CAS laboratories carried out the decontamination. In this procedure 20% hydrochloric acid (HCl) was replaced with 10% nitric acid. Collection vessels were delivered in cardboard boxes and stored as such until needed.	Composite and grab samples at all locations.	These changes did not impact the investigation.	
Decontamination of coated stir bars.	There was no method in the FSP. The method for glass collection vessels described in the text and above was used. Stir bars were stored in clean glass jars.	Composite and grab samples at all locations.	These changes did not impact the investigation.	
Decontamination of ISCO tubing and peristaltic pump tubing	Decontamination procedures were simplified so that all tubing associated with the ISCO was washed thoroughly with Liquinox® followed by a CAS DI rinse.	Composite and grab samples at all locations.	These changes did not impact the investigation.	
Decontamination of sampler mounts and other equipment	Equipment was washed with Liquinox® followed by a DI rinse. Brackets and other equipment were not scrubbed once installed.	Composite, grab, and sediment trap samples at all locations.	These changes did not impact the investigation.	
Decontamination of sediment trap processing equipment	Glass and stainless steel equipment – wash with soapy (Liquinox®) water and rinse with tap water, rinse with acetone, rinse with CAS DI, rinse with 10% nitric, and rinse 3 times with CAS DI water. Acrylic filter stand and peristaltic pump tubing – wash (or pump) soapy (Liquinox) water, rinse with tap water, and rinse three times with CAS DI water.	All sediment trap locations	These changes did not impact the investigation.	
Collection of Field Blanks				
Collection of additional rinsate and equipment blank samples	The FSP only discussed the collection of one equipment rinsate blank prior to deployment of the Isco samplers in the field. To provide additional information about the decontamination procedures and identify possible contamination sources through out entire sample collection and compositing sequence, additional equipment and/or rinsate blanks were created and analyzed as listed below:	Composite, grab, and sediment trap samples at all locations.	This change expected to improve the quality of the investigation.	
Collection of sediment trap rinsate blank	Sample LW3-STW-SRB01 was collected by pouring DI water over the surface of cleaned surface of sediment trap holders and collected directly into analytical bottles. This sample was analyzed for PAHs and phthalates.	All sediment trap locations	These changes did not impact the investigation.	
Collection of sediment trap bottle blank	The FSP specifies that the HDPE sediment trap bottles will be obtained certified clean from the laboratory and certified phthalate free. There are no such HDPE bottles available. Sample LW3-STW-BB01 was collected by pouring CAS DI water into 1L HDPE bottle of type being used for sediment traps and then transferring the water to an appropriate glass bottle for phthalate analysis. This bottle blank will be used to evaluate the background level of phthalates in the HDPE sediment trap bottles.	All sediment trap locations	This change expected to improve the quality of the investigation given that the bottle type called for in the FSP did not exist.	

Table 4-4. Summary of Deviations for Stormwater Sampling Program.

Sampling Activity	Deviations	Samples Affected	Impact of Deviation or Modification	Date of Stormwater Technical Meeting or Email where discussed.*
Collection of ISCO tubing rinsate blank	LW3-STW-WB01 was collected by pumping CAS DI water thru Isco tubing only (to verify decon procedures) and directly into analytical bottles. The sample was analyzed for TOC, total metals, PAHs, phthalates, pesticides, and herbicides.	Composite and grab samples at all locations.	This change expected to improve the quality of the investigation.	
Collection of additional ISCO rinsate blanks	LTW-STW-CWRB02 was collected by pumping CAS DI water through Isco tubing and sampling arm only, and collected directly in analytical bottles (bypassing the Isco collection bottles). This sample was analyzed for total and dissolved metals only.	Composite and grab samples at all locations.	This change expected to improve the quality of the investigation.	
Collection of additional ISCO rinsate blanks	LTW-STW-CWRB03 was collected by pumping CAS DI water through Isco tubing, sampling arm and into Isco bottles. The water was then collected directly in analytical bottles (with out compositing in glass carboys) and analyzed for total and dissolved metals only.	Composite and grab samples at all locations.	This change expected to improve the quality of the investigation.	
Collection of composite stormwater equipment rinsate blank.	LTW-STW-CWRB04 is representative of the entire stormwater composite process from Isco sample collection to compositing in field lab. This sample was collected using protocols described for composite stormwater samples in section 4.X. As per the FSP, this equipment rinsate blank sample was analyzed for full suite of analytical parameters except for conventionals TSS,TOC and DOC.	Composite and grab samples at all locations.	This change expected to improve the quality of the investigation.	
Stormwater Sample Collection/Processing				
Measurement of field water quality parameters	Field water quality parameters (i.e. temperature, pH, conductivity, turbidity and oxidation/reduction potential (ORP) were not measured in the field for any stormwater samples. Water quality measurements were performed at the field lab from the composited sample if sufficient volume was collected. Other deviations included selected incidences when the field water quality parameters could not be collected due to a) limited sample volumes and b) multi probe not operating correctly.	Composite and grab stormwater samples at all locations.	Field water quality parameters are not *in-situ* measurements. However, measurement in the field may not have been representative of the actual water used in the composite sample. All field parameters except turbidity and conductivitiy would be expected to be impacted by the compositing process. Additional discussion on impact of this change will be included in the associated data quality report.	
Collection of samples for phthalate analysis	Phthalate samples were not mixed manually with stainless steel rod as listed in FSP. Samples for phthalates analysis were collected in identical fashion to all other organic constituents. All sample handling was done wearing phthalate-free nitrile gloves.	Composite and grab stormwater samples at locations where phthalates were analyzed including stations: OF-18, St.John's Bridge, WR-123, WR-142/5, WR-161, WR-22, WR-96, OF-22C, OF-M2, and WR-147	None. There were no known sources of phthalates in the compositing apparatus so there was no reason for treating collection of phthalate samples differently from other sample analyses.	

Table 4-4. Summary of Deviations for Stormwater Sampling Program.

Sampling Activity	Deviations	Samples Affected	Impact of Deviation or Modification	Date of Stormwater Technical Meeting or Email where discussed.*
Time Based Sampling	Because of difficulties measuring velocity and consequently flow preceding the storm event and or simple lack of preceding flow data, some samplers were programmed to sample on a time-based approach. These samplers, once triggered by increased flow or water level, collected samples at equal time intervals until the sample bottles were full.	Specific instances presented in the Site Specific Sampling Report appendices. Stations where time based sampling was used at least once included: WR-96, WR-14, H-30, OF-49, WR-384, WR-123, St.John's Bridge, WR-218, WR-67, WR-145/2, WR-147	These changes did not impact the investigation. The water samples were composited on the basis of level or flow manually, so the intent of the composite sampling effort was maintained.	April 10, 2007 -- Stormwater Progress and Issues
Stormwater Sample Retrieval and Processing Holding Times	For some sampling events all samples could not be retrieved within 24 hours of the end of the event and processed within 12 hours after that, as required by the FSP.	As specified in Table 4-1: Storm 1 3/26/07: only WR-4*, All sites collected on Storm 2 on 4/9/2007 and Storm 4 on 4/23/2007, and Storm 8 4/11/07: only WR-123 and WR-384	Because the holding times were selected by the Stormwater Technical Team based on general technical judgment, there is likely no significant impact to the study by exceeding these times by a few hours in some cases.	April 10, 2007 -- Stormwater Progress and Issues
Grab Sample Collection/Processing				
Stormwater grab samples collection method	ISCO units were programmed to collect a grab sample and triggered remotely rather than being operated manually at the site as described in the FSP.	Grab samples at all designated grab locations	These changes did not impact the investigation.	
Filtering for grab sample dissolved analyses	Although composite samples for DOC and dissolved metals were filtered through a 0.45 micron filter, the closest glass fiber filter pore size available is 0.5 micron, and this pore size was used for grab samples.	All grab samples collected for dissolved organic and DOC analyses	The difference of 0.05 micron in filter pore size between composite samples collected for dissolved metal analyses and DOC, and the grab samples collected for dissolved organics and DOC is not expected to be analytically significant. These changes did not impact the investigation.	
Storm Selection for Grab Sampling	Depart from the FSP storm criteria and allow grab water sampling to take place for any storm that produces flow that also has a 24-hour antecedent dry condition. As a consequence, the sampling team collected composite water samples at all stations where composite data were still needed for any storm that is expected to meet all the FSP storm criteria. If the FSP criteria for rainfall amount or duration were not expected to be met, then the collection team collected grab samples at the 10 grab sample sites. The grab sampling targeted collecting samples as soon possible after runoff is observed to start at each site.	All Grab Sampling Locations	These changes did not impact the investigation.	April 30, 2007 -- Stormwater Technical Team Conf. Call
Sediment Sample Processing				
Sediment compositing procedures	Sediment was removed from the sample bottles using the method described in Section 6.5, while the FSP describes a slightly different equipment and procedure.	All sediment trap locations	These changes did not impact the investigation.	

Table 4-4. Summary of Deviations for Stormwater Sampling Program.

Sampling Activity	Deviations	Samples Affected	Impact of Deviation or Modification	Date of Stormwater Technical Meeting or Email where discussed.*
Trap Deployed Less Than 90 Days or Interupted Collection Period	Due access issues, the trap at WR-218 was deployed for less than the 90 days (3 months) required by the FSP, while all other traps were deployed 90 days or more. In two cases (OF-49 and WR-96), caps were left on bottles between inspections, which interuppted the collection period, although the total collection time (without caps on) was in excess of 90 days for both sites.	WR-218, OF-49, WR-96	Given the low rate of sediment collection, this deivation is not expected to substantially impact the investigation.	
Sediment samples frozen for holding	The FSP specifies holding samples at 4 degrees C and analysis within certain holding times. Due to ongoing discussions with the Stormwater Technical Team regarding how to best utilize limited sample volumes. It was discussed and agreed that the samples should be frozen so that the holding times in the FSP would no longer apply and the samples would be acceptable for analyses for up to 6 months.	All sediment trap locations	These change did not impact the investiation.	May 18, 2007 -- Notes from May 18 call and June 4 Stormwater Technical Team
Quality Assurance/Quality Control				
Sediment trap QC samples	Sediment was collected directly from the catch basins (WR4*, WR14, and WR107) as described in Section 6.9.	All sediment trap locations	These changes did not impact the investigation. This sediment was collected due to the limited quantity collected from the sediment traps. These samples will be used by the laboratory to run the required QA/QC for the sediment portion of this investigation.	August 13-14, 2007 -- Stormwater Technical Team Call Highlights (Aug. 13th call)
Sample Storage				
Storage temperature quality control	Refrigeration units were not monitored daily. All refrigerator temperatures were verified prior to storage of any samples collected during a particular storm event . Refrigerators were generally monitored at least once per week during the four month period of stormwater sampling events.	Composite, grab, and sediment trap samples at all locations.	These changes did not impact the investigation. Monitoring that was conducted did not indicate any abnormalities with the refrigeration units.	
Sampling Locations				
Moving WR-145 sampler to WR-142	During the course of the sampling effort, construction of a barge on the Gunderson site restricted access to the WR-145 sampling location and blocked runoff from the outfall. In order to continue sampling at the Gunderson site, the sampler was moved to Outfall WR-142.	WR-145 and WR-142	These changes did not impact the investigation. These two outfalls are located approximately 100 feet from each other and have similar land use.	April 30, 2007 -- Stormwater Technical Team Conf. Call
Changing the sampling location from WR-108 to WR-384 on the Schnitzer Steel site	During reconnaisance, it was discoved that all runoff draining to outfall WR-108 was pumped to a pilot treatment system before discharge. In order to use a sample more representative of site activity, the Technical Team decided to sample WR-384.	WR-384	These changes did not impact the investigation. These two outfalls have similar land use.	March 7, 2007 - Schnitzer Site Map

Table 4-4. Summary of Deviations for Stormwater Sampling Program.

Sampling Activity	Deviations	Samples Affected	Impact of Deviation or Modification	Date of Stormwater Technical Meeting or Email where discussed.*
Installing the sampling location downstream of the sampling MH for HWY 30 instead of upstream.	The station at Highway 30 was intended to be representative of runoff primarily from a major transportation corridor. The sampling location was in a manhole that had input from both the highway and from a side branch draining a small industrial area. The intended location of sampling was just upstream of this side branch, when inadvertently the actual sampling location was placed just downstream of this same branch. Thus, it is likely that the samples collected were influenced by both the highway runoff (5 acres) and industrial land use runoff (13 acres).	HWY 30	This deviation is expected to have impact on calculation of major transportation representative pollutant loads.	
Installing the sampling location at a different outfall than WR-4 on the Sulzer site.	The FSP indicated that WR-4 would be sampled. However, during preparation of this FSR, it was discovered that a different outfall was sampled. Subsequent research, reconnaissance and discussions with Sulzer, DEQ, the City of Portland, and Sulzer's environmental consultants have discovered that multiple conflicting storm drainage and outfall maps exist for the site. The intention of sampling WR-4 was to sample the unique site activities of the Sulzer industrial location. It has been determined that the outfall location sampled as a part of this FSR does not drain the basin intended to be sampled and is not likely to be representative of the unique site activities. Further study is needed to determine the basin draining to the sampled outfall. The outfall identification name for the sampled outfall will be determined as part of the Outfall Verification Study being currently being conducted by Integral Consulting. Because sample identification sent to the lab refers to WR-4, this FSR will refer to WR-4*.	WR-4*	This deviation is expected to have impact on calculation of unique pollutant loads from the Sulzer site.	
Sampling by other entities				
Sampling conducted by GE	GE was preparing to collect stormwater samples as part of the DEQ Cleanup program stormwater pathway evaluation. The work plan did not include sediment traps, however, GE agreed to collect sediment from stormwater vaults if available. Because suitable monitoring locations downstream of this site did not exist, the tech team determined that data collected by GE would be used in the data evaluation.	GE Decommissioning draining to OF-17	These changes did not impact the investigation. This data will still be used in the data evaluation.	March 7, 2007 - Schnitzer Site Map

Note:
*Note minor or uncontrollable deviations typical of any sampling program were not necessarily discussed with the Stormwater Technical Team in advance.

Table 5-1. Summary of Round 3A Stormwater Grab Samples Collected by Site and Storm Event.

Appendix	Outfall(s)	Facility or Location	Station ID	Grab Sample ID	Date Collected	TSS	TOC	DOC (filtered)	PAHs	PAHs (filtered)	Phthalates	Phthalates (filtered)	PCB Congeners	PCB Congeners (filtered)	Herbicides	Herbicides (filtered)	OC Pesticides	OC Pesticides (filtered)
A	WR-22	OSM	WR-22	LW3-STW-GW10-WR22	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
B	WR-123	Schnitzer International Slip	WR-123	LW3-STW-GW10-WR123	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
D	WR-107	GASCO	WR-107	LW3-STW-GW10-WR107	5/21/2007	X	X	X	X	X	--	--	X	X	X	X	--	--
E	WR-96	Arkema	WR-96	LW3-STW-GW10-WR96	6/5/2007	X	X	X	X	X	X	X	X	X	X	X	X	X
G	WR-161	Portland Shipyard	WR-161	LW3-STW-GW10-WR161	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
G	WR-161	Portland Shipyard	WR-161	LW3-STW-GW20-WR161	6/5/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
I	WR-142	Gunderson	WR-142	LW3-STW-GW10-WR142	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
O	OF-22B	City - Doane Lake Industrial Area	OF-22B	LW3-STW-GW10-OF22B	6/5/2007	X	X	X	X	X	--	--	X	X	X	X	X	X
R	OF-22	City - Willbridge Industrial Area	OF-22	LW3-STW-GW10-OF22	6/5/2007	X	X	X	X	X	--	--	X	X	NC	NC	--	--
U	St. Johns Bridge	Highway drainage	SJB	LW3-STW-GW10-SJB	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--
V	OF-18	City - Multiple Land Uses	OF-18	LW3-STW-GW10-OF18	5/21/2007	X	X	X	X	X	X	X	X	X	X	X	--	--

Note:
NC = Parameter not collected due to insufficient volume.
-- = The FSP does not require analysis of this parameter for this station.

Table 5-2. Summary of Field QC Samples for Round 3A Stormwater Grab Samples.

Sample Event ID	Station	Date Collected	QC Sample Type	Analyses										
				TSS	TOC	DOC (filtered)	PAHs	PAHs (filtered)	Phthalates	Phthalates (filtered)	PCB Congeners	PCB Congeners (filtered)	Herb-icides	Herb-icides (filtered)
LW3-STW-GW10-SJB-2-T	SJB	21-May-07	field replicate		X		X							
LW3-STW-GW10-WR107-2-T	WR-107	21-May-07	field replicate	X										
LW3-STW-GW10-WR142-2-T	WR-142	21-May-07	field replicate					X						
LW3-STW-GW10-W900-D	NA	21-May-07	Field Blank of WR-123, WR-22, WR-107, WR1-42, OF-18, St Johns Bridge			X		X		X		X		X
LW3-STW-GW10-W900-T	NA	21-May-07	Field Blank of WR-123, WR-22, WR-107, WR-142, OF-18, St Johns Bridge	X	X		X		X		X		X	
LW3-STW-GW10-W902-T	NA	5-Jun-07	Field Blank of OF-22, OF-22B, WR-161, and WR-96.	X	X		X		X		X		X	

Table 6-1 - Summary of Sediment Trap Installation and Collection Dates and Total Rainfall

Appendix	Outfall(s)	Facility or Location	Station ID	Sample ID	Date Trap Installed	Date(s) Sediment Collected	Date Sediment Processed	Date Submitted to Laboratory for Analysis	Total Rainfall During Deployment (in.)
A	WR-22	OSM	WR-22	LW3-STW-S10-WR22	4/20/2007	5/22/2207	5/24/2007	6/11/2007	8.09
B	WR-123	Schnitzer International Slip	WR-123	LW3-STW-S10-WR123	3/26/2007	5/23/2007, 6/30/2007	7/3/2007	7/6/2007	4.29
C	WR-384	Schnitzer - Riverside	WR-384	LW3-STW-S10-WR384	3/26/2007	7/3/2007	7/3/2007	7/6/2007	4.29
D	WR-107	GASCO	WR-107	LW3-STW-S10-WR107	3/6/2007	5/23/2007, 7/02/2007	7/2/2007	7/3/2007	7.11
E	WR-96[2]	Arkema	WR-96	No sediment collected	2/22/2007	7/3/2007	NA	NA	8.44
F	WR-14	Chevron - Transportation	WR-14	LW3-STW-S10-WR14	3/1/2007	5/23/2007, 7/03/2007	7/3/2007	7/6/2007	8.26
G	WR-161	Portland Shipyard	WR-161	LW3-STW-S10-WR161	3/16/2007	7/3/2007	7/3/2007	7/6/2007	6.38
H	WR-4*	Sulzer Pump	WR-4*	LW3-STW-S10-WR4	2/22/2007	5/23/2007, 7/02/2007	7/2/2007	7/3/2007	10.80
I	WR-145/142	Gunderson	WR-145	LW3-STW-S10-WR145	3/5/2007 (moved to WR-142 on 5/1/2007)	5/1/2007, 07/03/2007	7/5/2007	7/6/2007	6.93
J	WR-147	Gunderson	WR-147	LW3-STW-S10-WR147	3/5/2007	5/23/2007, 7/03/2007	7/3/2007	7/6/2007	6.93
K	Hwy 30	Hwy 30	H30	LW3-STW-S10-H30	3/27/2007	5/23/2007, 7/03/2007	7/2/2007	7/3/2007	4.58
L	OF-49	City - St. Johns Area	OF-49	LW3-STW-S10-OF49	1/31/2007	7/3/2007	7/5/2007	7/6/2007	12.97
M	WR-67	Siltronic	WR-67	LW3-STW-S10-WR67	2/22/2007	7/2/2007	7/2/2007	7/3/2007	10.84
N	OF-22C	City - Above Hwy 30, Forest Park Area	OF-22C	LW3-STW-S10-OF22C	1/30/2007	5/23/2007, 7/02/2007	7/3/2007	7/6/2007	13.93
O	OF-22B	City - Doane Lake Industrial Area	OF-22B	LW3-STW-S10-OF22B	3/15/2007	7/2/2007	7/2/2007	7/3/2007	6.52
P	OF-M1	City - Mocks Bottom	OF-M1	LW3-STW-S10-OFM1	3/8/2007	6/6/2007	6/7/2007	6/11/2007	6.14
Q	OF-M2	City - Mocks Bottom	OF-M2	LW3-STW-S10-OFM2	3/8/2007	6/6/2007	6/7/2007	6/11/2007	6.14
R	OF-22[1]	City - Willbridge Industrial Area	OF-22	LW3-STW-S10-OF22, LW3-STW-S20-OF22	1/30/2007	05/03/2007, 07/02/2007	7/5/2007	7/6/2007	8.09
S	OF-16	City - Heavy Industrial	OF-16	LW3-STW-S10-OF16	3/16/2007	5/22/2007, 7/02/2007	7/3/2007	7/3/2007	6.30
T	WR-218	Albina - UPRR	WR-218	LW3-STW-S10-WR218	2/22/2007	7/3/2007	7/5/2007	7/6/2007	2.17
U	St. Johns Bridge	Highway drainage	SJB	LW3-STW-S10-SJB	3/22/2007	5/22/2007, 7/02/2007	7/2/2007	7/3/2007	6.12
V	OF-18	City - Multiple Land Uses	OF-18	LW3-STW-S10-OF18	3/15/2007	5/22/2007, 7/02/2007	7/2/2007	7/3/2007	6.30
W	OF-19	City - Multiple Land Uses	OF-19	LW3-STW-S10-OF19-1 LW3-STW-S10-OF19-2	3/15/2007	5/22/2007, 7/02/2007	7/3/2007	7/6/2007	6.30

Notes:

1 - For outfall OF-22, sediment trap samples were collected in two separate events. Sediment from the traps removed on 5/3/07 were processed as sample ID LW3-STW-S10-OF22. Sediment from the traps removed on 7/2/07 were processed as sample ID LW3-STW-S20-OF22.

2 - No sample was submitted to the laboratory because there was not sufficient sediment to process.

Table 6-2. Summary of Field QC Samples for Round 3A Stormwater Sediment Trap and Catch Basin Sediment Samples.

Sample Event ID	Date Collected	QC Sample Type	Station	Analyses						
				TOC	Total Metals	PAHs	Phthalates	PCB Congeners	Herbicides	Organo-chlorine Pesticides
LW3-STW-SRB01	26-Feb-07	Equipment rinsate blank of entire sediment trap	NA			X	X			
LW3-STW-BB01	1-Mar-07	Equipment rinsate blank of sediment trap bottles	NA				X			
LW3-STW-S10-W900	24-May-07	Rinsate blank of sample processing equipment	NA		X	X	X	X	X	X
LW3-STW-CB10-WR4	TBD	Field Duplicate (Catch Basin)	WR4*	X		X	X		X	
LW3-STW-CB10-WR14	TBD	Field Duplicate (Catch Basin)	WR14	X	X			X		X
LW3-STW-CB10-WR107	TBD	Field Duplicate (Catch Basin)	WR107	X	X	X	X	X	X	X

Note:
Analysis of additional field QC samples will be determined once the sediment trap analysis scope had been finalized

Table 6-3. Sediment Trap Sample Prioritization Summary - Showing Target Detection Limit Factors[1]

Appendix	Outfall(s)	Facility or Location	PCB Congeners	TOC	Percent Solids	Organo-chlorine pesticides	PAHs and Phthalates	Metals	Herbicides	Grain Size
Industrial Locations (10)										
A	WR-22	OSM	1	1	1	1	1	1	1.3	
B	WR-123	Schnitzer International Slip	1	1	1	1				
C	WR-384	Schnitzer - Riverside	1	1	1	1	1	1	1	
D	WR-107	GASCO	1	1	1	1	1	1	1	
E	WR-96	Arkema								
F	WR-14	Chevron - Transportation	1	1	1	1				
G	WR-161	Portland Shipyard	1	1	1	4				
H	WR-4*	Sulzer Pump	3.3	1	1					
I	WR-145	Gunderson	6	1	1					
J	WR-147/148	Gunderson (former Schnitzer)	1	1	1	5.3				
Land Use Locations (11)										
K	Hwy 30	Hwy 30	1.8	1	1					
L	OF-49	City - St. Johns Area		1	1	22.2				
M	WR-67	Siltronic	1	1	1	4.8				
N	OF-22C, above Hwy 30	City - Forest Park Area	1	1	1	1	1	1	1	
O	OF-22B	City - Doane Lake Industrial Area	1.5	1	1					
P	OF-M1 (combined)	City - Mocks Bottom Industrial Area	1	1	1	1	1.6			
Q	OF-M2	City - Mocks Bottom Industrial Area	1	1	1	1	1.6			
R	OF-22 (combined)	City - Willbridge Industrial Area	1.3	1	1					
S	OF-16	City - Heavy Industrial	1	1	1	1	1.2			
T	WR-218	UPRR Albina	1.9	1	1					
U	St. Johns Bridge	Highway drainage	1	1	1	1	2.4			
Multiple Land Use Locations (2)										
V	OF-18	City - Multiple Land Uses	1	1	1	1	1.1			
W	OF-19 (combined)	City - Multiple Land Uses	1	1	1	1	1	1	1	

Note:

[1] Detection limit factor shows how the target detection limit (DL) will be exceeded with the sample mass remaining. A factor of 1 means the target detection limit will be achieved. A factor of 2 means the actual DL will be two times higher than the target DL.

Blank cells indicate that there was insufficient sample volume to condut these analyses.

Table 7-1. Laboratory Methods for Water Samples.

Analytes	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	**Procedure**	**Protocol**	**Procedure**
Conventional Analyses	CAS				
Total Suspended Solids		EPA 160.2	Filtration and drying	EPA 160.2	Balance
Total Organic Carbon		EPA 415.1	Chemical oxidation	EPA 415.1	Infrared detector
Metals	CAS				
Aluminum, antimony, cadmium, total chromium, copper, lead, nickel, selenium, silver, zinc		EPA 3005	Acid digestion	EPA 200.8	ICP/MS
Arsenic		EPA 3005A (Modified)	Acid Digestion/pre-concentration	EPA 200.8	ICP/MS
Mercury		EPA 7470	Acid digestion/oxidation	EPA 7470	CVAA
Phthalate Esters	CAS	EPA 525.2	Solid-phase extraction	EPA 525.2	GC/MS
Chlorinated Herbicides	CAS	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS	EPA 3545	Pressurized fluid extraction	EPA 8081A	GC/ECD
		EPA 3640A	Gel permeation chromatography		
		EPA 3630C	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup (as needed)		
Polycyclic Aromatic Hydrocarbons	CAS	EPA 3520C	Continuous liquid-liquid extraction	EPA 8270C	GC/MS-SIM
PCB congeners[1]	Axys	EPA 1668A	Florisil® cleanup	EPA 1668A	HRGC/HRMS
			Extract fractionation		
			Layered Acid/Base SiO_3 Alumina		

Notes:

[1] Analysis will be completed for all 209 PCB congeners.

CAS - Columbia Analytical Services
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high resolution gas chromatography/high resolution mass spectrometry
ICP/MS - inductively coupled plasma - mass spectrometry
LVI - large-volume injector
SIM - selected ion monitoring
SOP - standard operating procedures

Table 7-2. Laboratory Methods for Sediment Samples.

Analysis	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	Procedure	Protocol	Procedure
Conventional Analyses	CAS Kelso				
Total solids		--	--	PSEP 1986	Balance
Grain size		--	--	PSEP 1986	Sieve and pipette method
Total organic carbon		Plumb 1981	Acid pretreatment	Plumb et al. 1981	Combustion; coulometric titration
Metals	CAS Kelso				
Antimony, arsenic[1], cadmium, lead, silver		EPA 3050	Strong acid digestion	EPA 6020	ICP/MS
Aluminum, chromium, copper, nickel, zinc		EPA 3050	Strong acid digestion	EPA 6010B	ICP/AES
Selenium		EPA 3050	Strong acid digestion	EPA 7742	AAS
		EPA 7742	Hydride generation		
Arsenic[1]		EPA 3050	Strong acid digestion	EPA 7062	AAS
Mercury		EPA 7471A	Acid digestion/oxidation	EPA 7471A	CVAA
Chlorinated herbicides	CAS Kelso	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS Kelso	EPA 3541	Soxhlet extraction	EPA 8081A	GC/ECD
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		
PCB Aroclors	CAS Kelso	EPA 3541	Soxhlet extraction	EPA 8082	GC/ECD
		EPA 3665A	Sulfuric acid cleanup		
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		

Table 7-2. Laboratory Methods for Sediment Samples.

Analysis	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	Procedure	Protocol	Procedure
Semivolatile organic compounds	CAS Kelso				
PAHs and phthalates		EPA 3541	Automated Soxhlet Extraction	EPA 8270C	GC/MS-LVI
		EPA 3640A	Gel permeation chromatography		
PCB Congeners[2]	Vista	EPA 1668A	Soxhlet/Dean Stark extraction	EPA 1668A	HRGC/HRMS
			Sulfuric acid cleanup		
			Silica column cleanup		

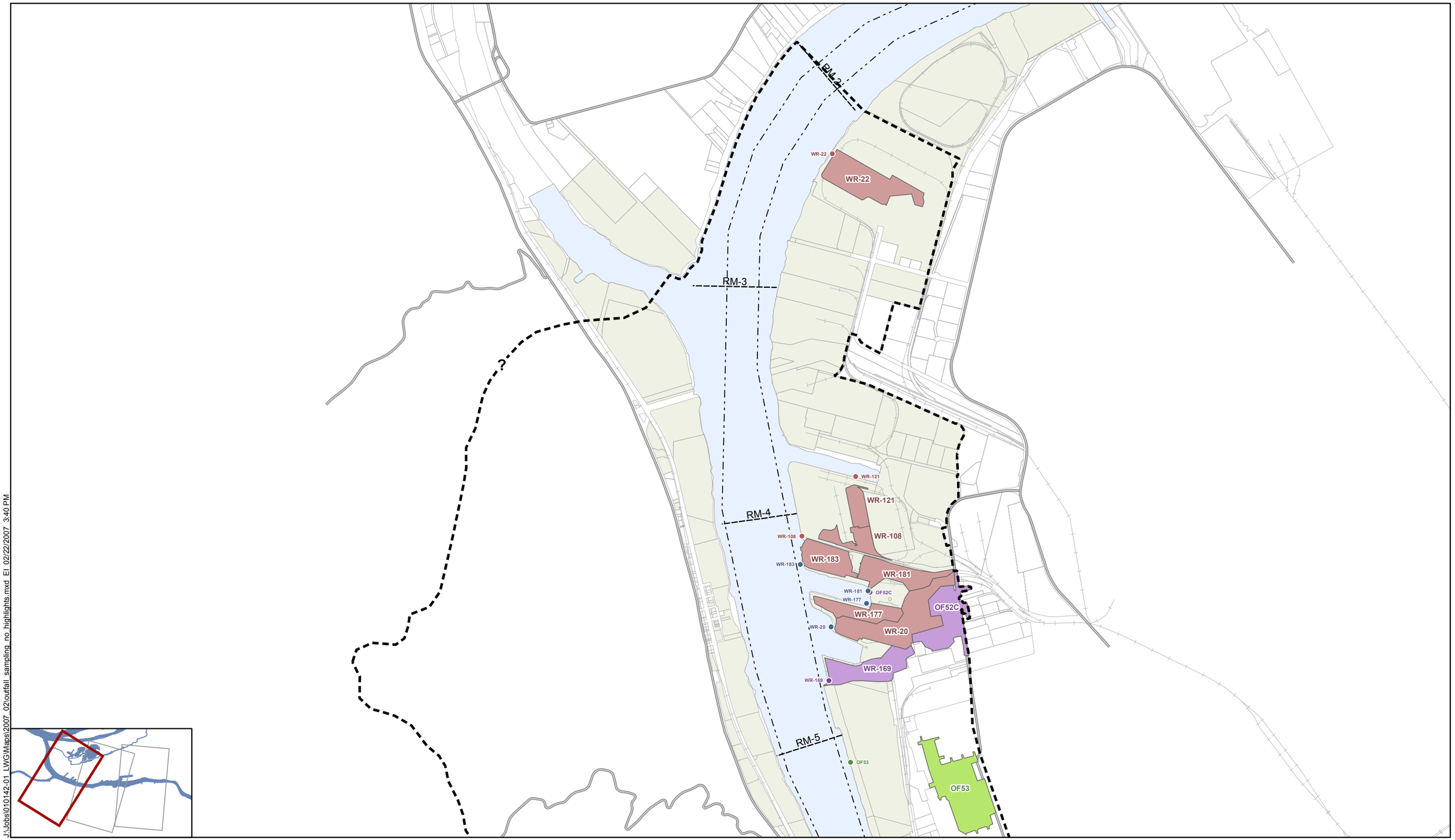
Notes:

[1]Arsenic will be analyzed by EPA Method 7062 if it is not detected at the MRL by EPA Method 6020.

[2] Analysis will be completed for all 209 PCB congeners.

AAS - Atomic absorption spectrometry
CAS - Columbia Analytical Services
CVAA - cold vapor atomic absorption spectrometry
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/FID - gas chromatography/flame ionization detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high-resolution gas chromatography/high-resolution mass
ICP/AES - inductively coupled plasma/atomic emission spectrometry
ICP/MS - inductively coupled plasma - mass spectrometry
LVI - large-volume injector
TPH - total petroleum hydrocarbon
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PSEP - Puget Sound Estuary Program
SIM - selected ion monitoring
STL - Severn Trent Laboratories
SVOC - semivolatile organic compound

Figures



J:\Jobs\010142-01 LWG\Maps\2007_02\outfall_sampling_no_highlights.mxd EI 02/22/2007 3:40 PM

ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

N

0 500 1,000 1,500 2,000 Feet

Map Features:

Stormwater Sampling Locations
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

Outfall Drainage basins
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

DO NOT QUOTE OR CITE:
This document is currently under review by U.S. EPA and its federal, state and tribal partners, and is subject to change in whole or in part.

Figure 2-1a
Proposed Round 3A Stormwater Field Sampling Report
Lower Willamette Group
River Mile 02 to 05

J:\Jobs\010142-01 LWGIMaps\2007_02\outfall_sampling_no_highlights.mxd EI 02/22/2007 3:40 PM

RM-5
RM-6
RM-7
RM-8
OF53
St. Johns Bridge
WR-107
OF49
WR-67
OF-22C
OF22C
OF22B
WR-96
WR-14
OF22
OF19
WR-161
OFM-1
OFM-2

ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

0 500 1,000 1,500 2,000 Feet

Map Features:

Stormwater Sampling Locations
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

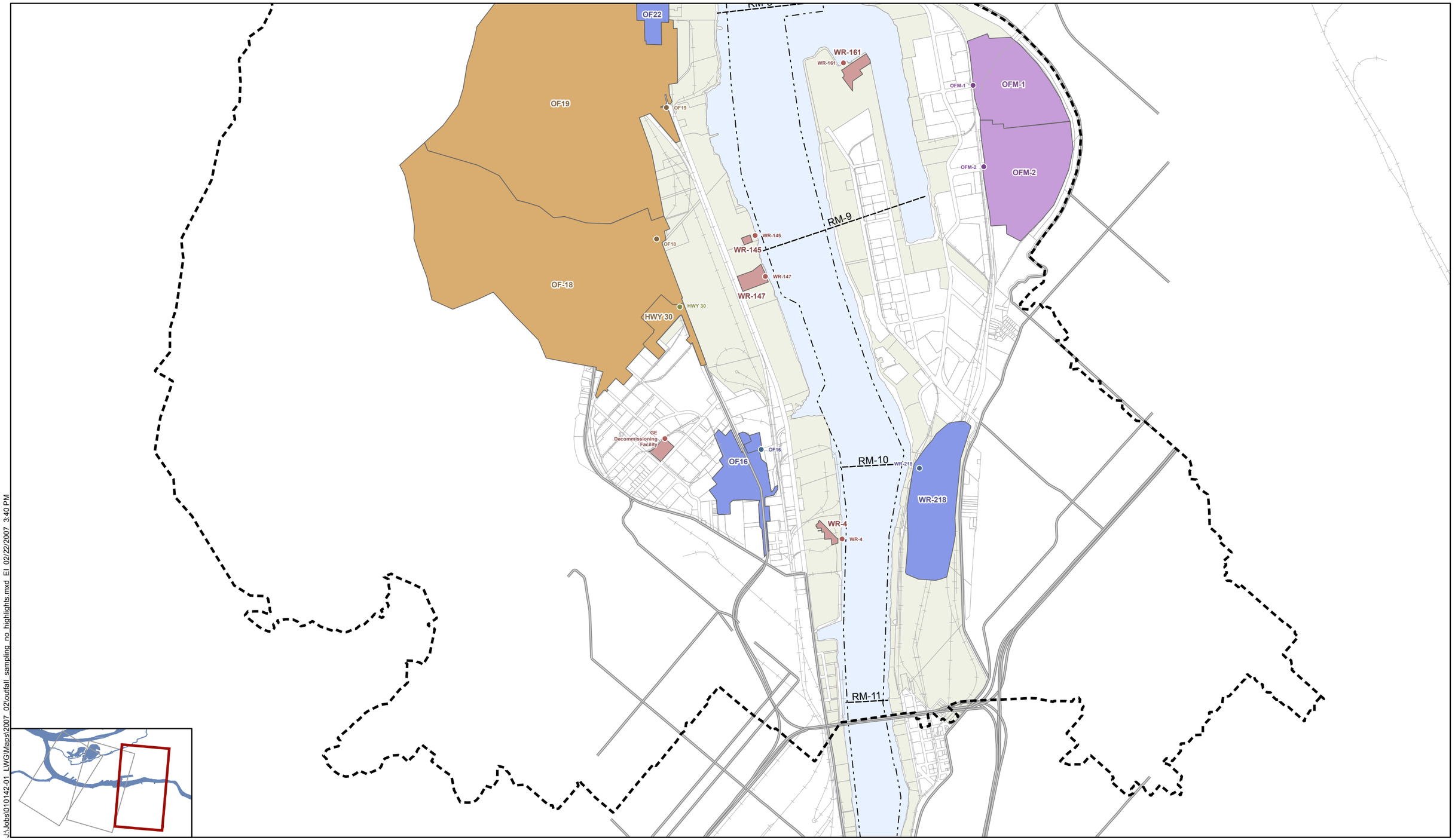
Outfall Drainage basins
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

DO NOT QUOTE OR CITE:
This document is currently under review by U.S. EPA and its federal, state and tribal partners, and is subject to change in whole or in part.

Figure 2-1b
Proposed Round 3A Stormwater Field Sampling Report
Lower Willamette Group
River Mile 05 to 08



J:\Jobs\010142-01_LWGIMaps\2007_02\outfall_sampling_no_highlights.mxd EI 02/22/2007 3:40 PM

ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

0 500 1,000 1,500 2,000 Feet

Map Features:

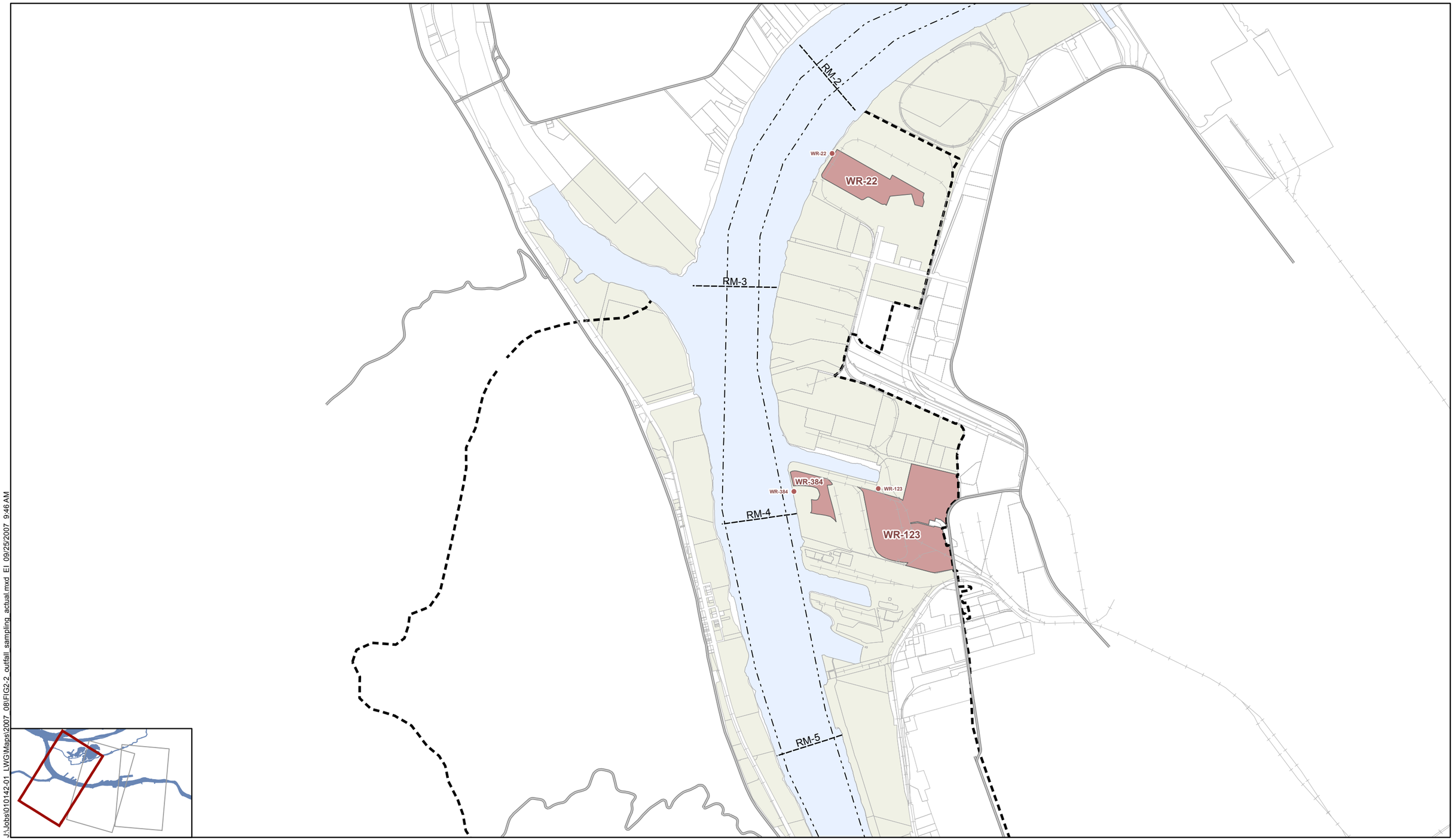
Stormwater Sampling Locations
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

Outfall Drainage basins
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

Figure 2-1c
Proposed Round 3A Stormwater Field Sampling Report
Lower Willamette Group
River Mile 08 to 11



J:\Jobs\010142-01_LWG\Maps\2007_08\FIG2-2_outfall_sampling_actual.mxd EI 09/25/2007 9:46 AM

ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

N

0 500 1,000 1,500 2,000 Feet

Map Features:

Stormwater Sampling Location
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

Approximate Basin Upstream From Sample
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

NOTE:
The drainage basin for HWY 30 is also part of the OF18 drainage basin.
*The outfall name designation and basin will be determined at a later date, as discussed in Section 2.0.

Figure 2-2a
Round 3A Stormwater Field Sampling Locations
Lower Willamette Group
River Mile 02 to 05

J:\Jobs\010142-01_LWGIMaps\2007_08\FIG2-2_outfall_sampling_actual.mxd EI 09/25/2007 9:46 AM

RM-5

St. Johns Bridge

RM-6

WR-107

OF-49

OF-22C

WR-67

RM-7

OF-22B

WR-96

OF-22

WR-14

RM-8

OF-19

WR-161

OF-M1

OF-M2

ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

0 500 1,000 1,500 2,000 Feet

Map Features:

Stormwater Sampling Location
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

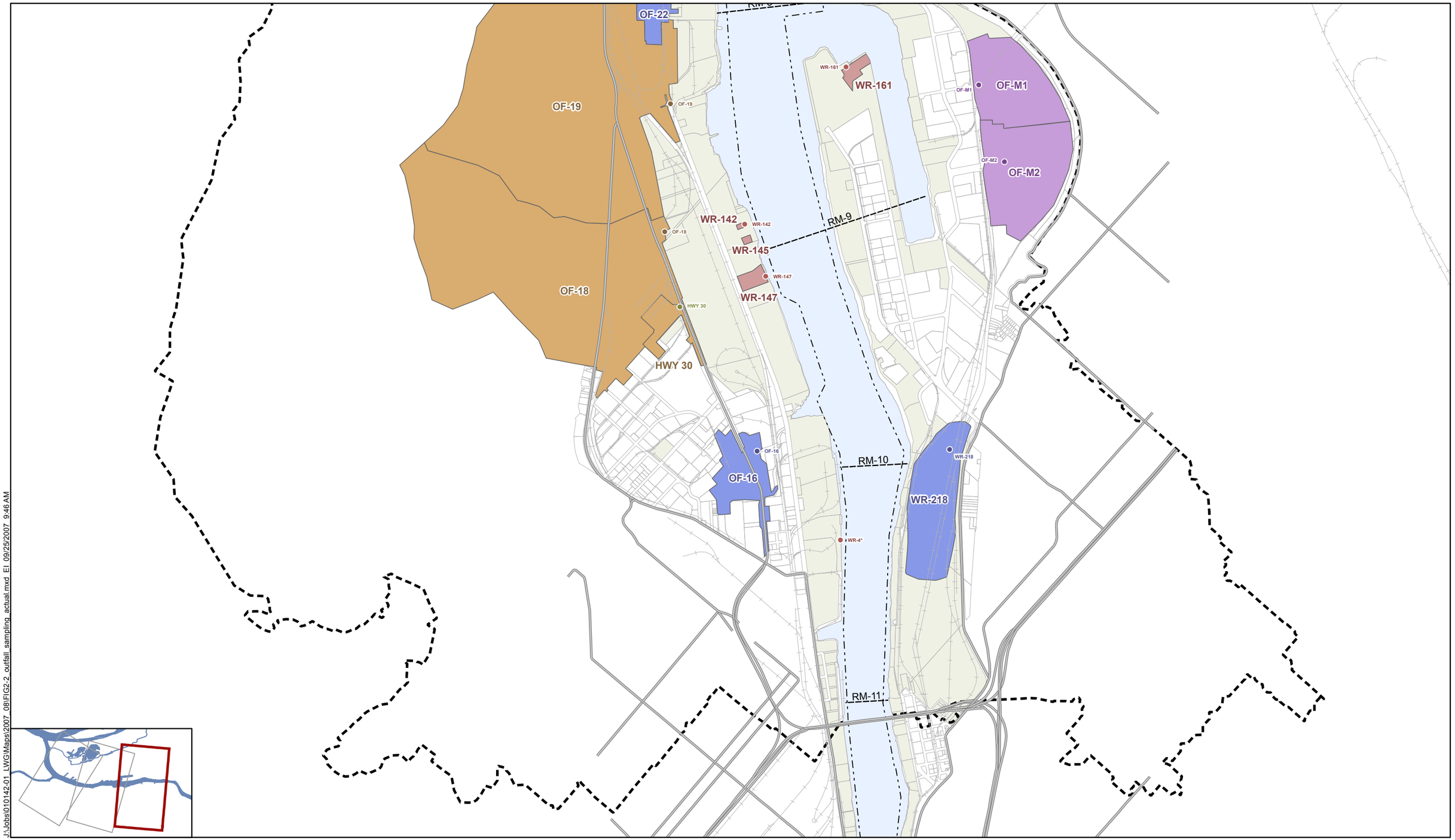
Approximate Basin Upstream From Sample
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

NOTE:
The drainage basin for HWY 30 is also part of the OF18 drainage basin.
*The outfall name designation and basin will be determined at a later date, as discussed in Section 2.0.

Figure 2-2b
Round 3A Stormwater Field Sampling Locations
Lower Willamette Group
River Mile 05 to 08



J:\Jobs\010142-01_LWG\Maps\2007_08\FIG2-2_outfall_sampling_actual.mxd EI 09/25/2007 9:46 AM

ANCHOR ENVIRONMENTAL, L.L.C.

0 500 1,000 1,500 2,000 Feet

LWG LOWER WILLAMETTE GROUP

Map Features:

Stormwater Sampling Location
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

Approximate Basin Upstream From Sample
- Heavy Industrial - Land Use Category
- Heavy Industrial - Site Specific
- Light Industrial
- Major Transportation
- Multiple Land Uses
- Residential
- Open Space

- Approx. Drainage Boundary
- Navigation Channel
- Waterfront Taxlots
- Waterfront Ownership
- River miles

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

NOTE:
The drainage basin for HWY 30 is also part of the OF18 drainage basin.
*The outfall name designation and basin will be determined at a later date, as discussed in Section 2.0.

Figure 2-2c
Round 3A Stormwater Field Sampling Locations
Lower Willamette Group
River Mile 08 to 11

Figure 3-1 - Measured Precipitation at Rain Gages, March 24th - 25th

March 26th Sampling Event

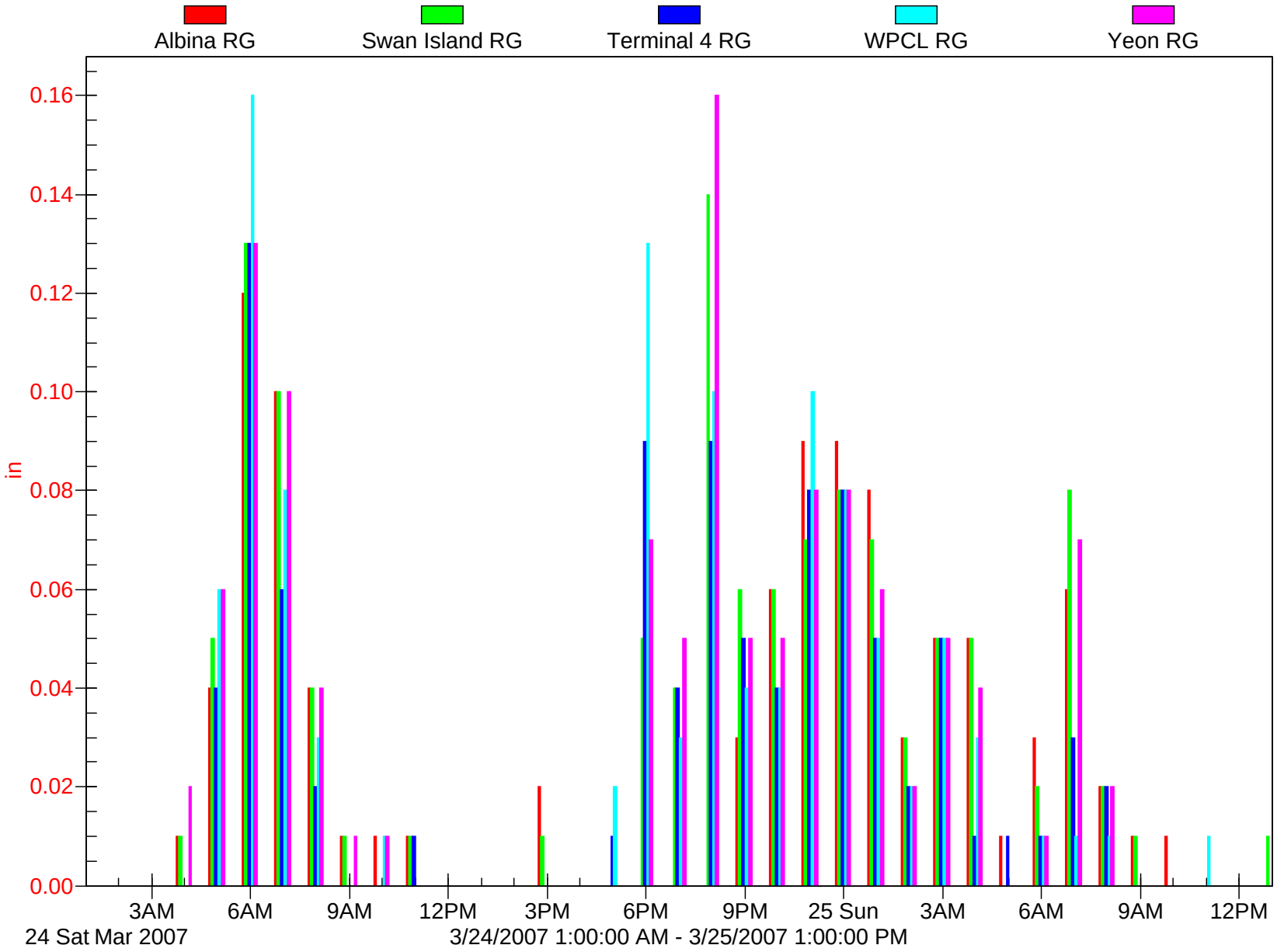


Figure 3-2 - Measured Precipitation at Rain Gages, April 7th - 9th

April 9th Sampling Event

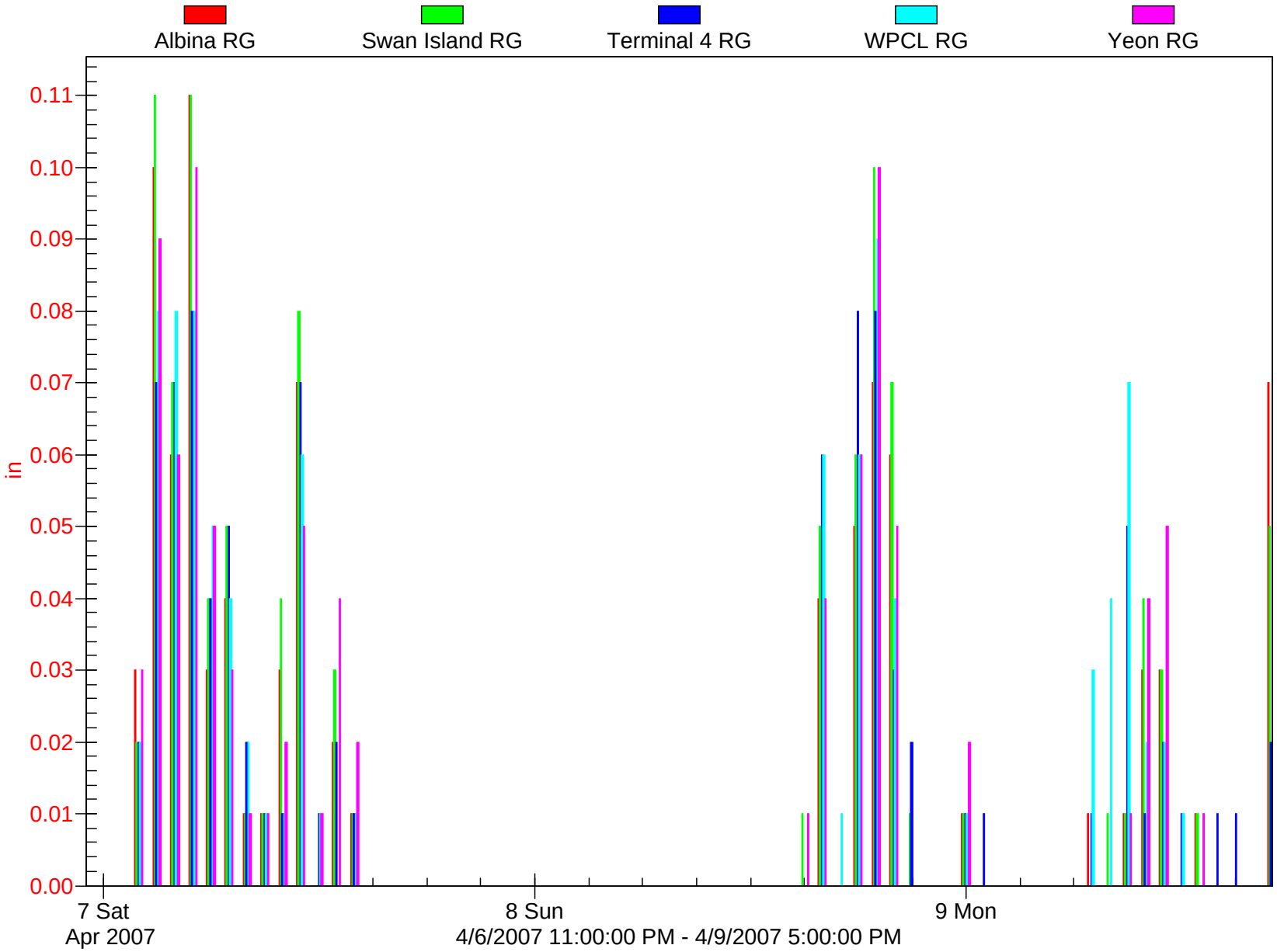


Figure 3-3 - Measured Precipitation at Rain Gages, April 16th - 18th

April 18th Sampling Event

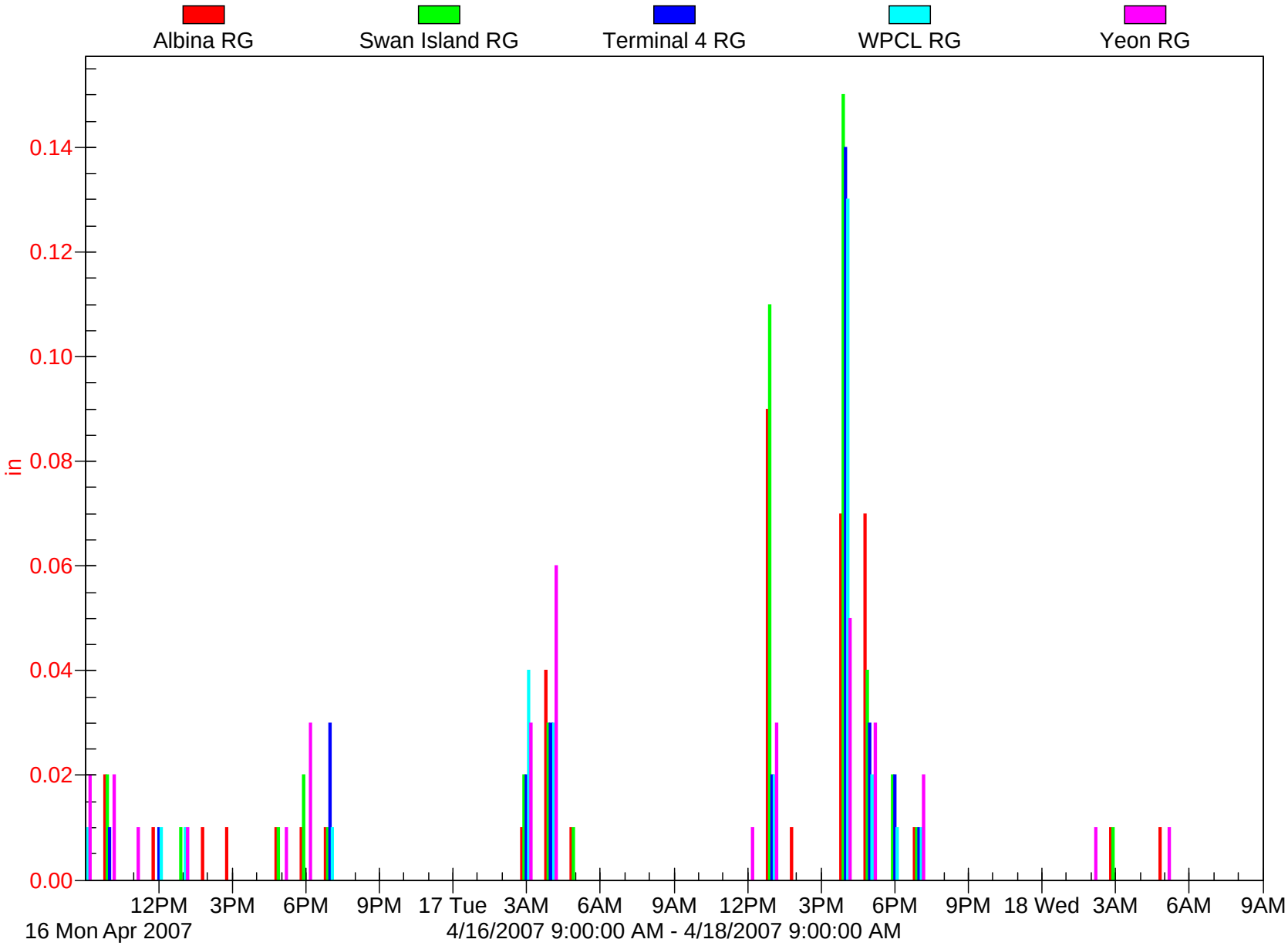


Figure 3-4 - Measured Precipitation at Rain Gages, April 21st - 22nd

April 23rd Sampling Event

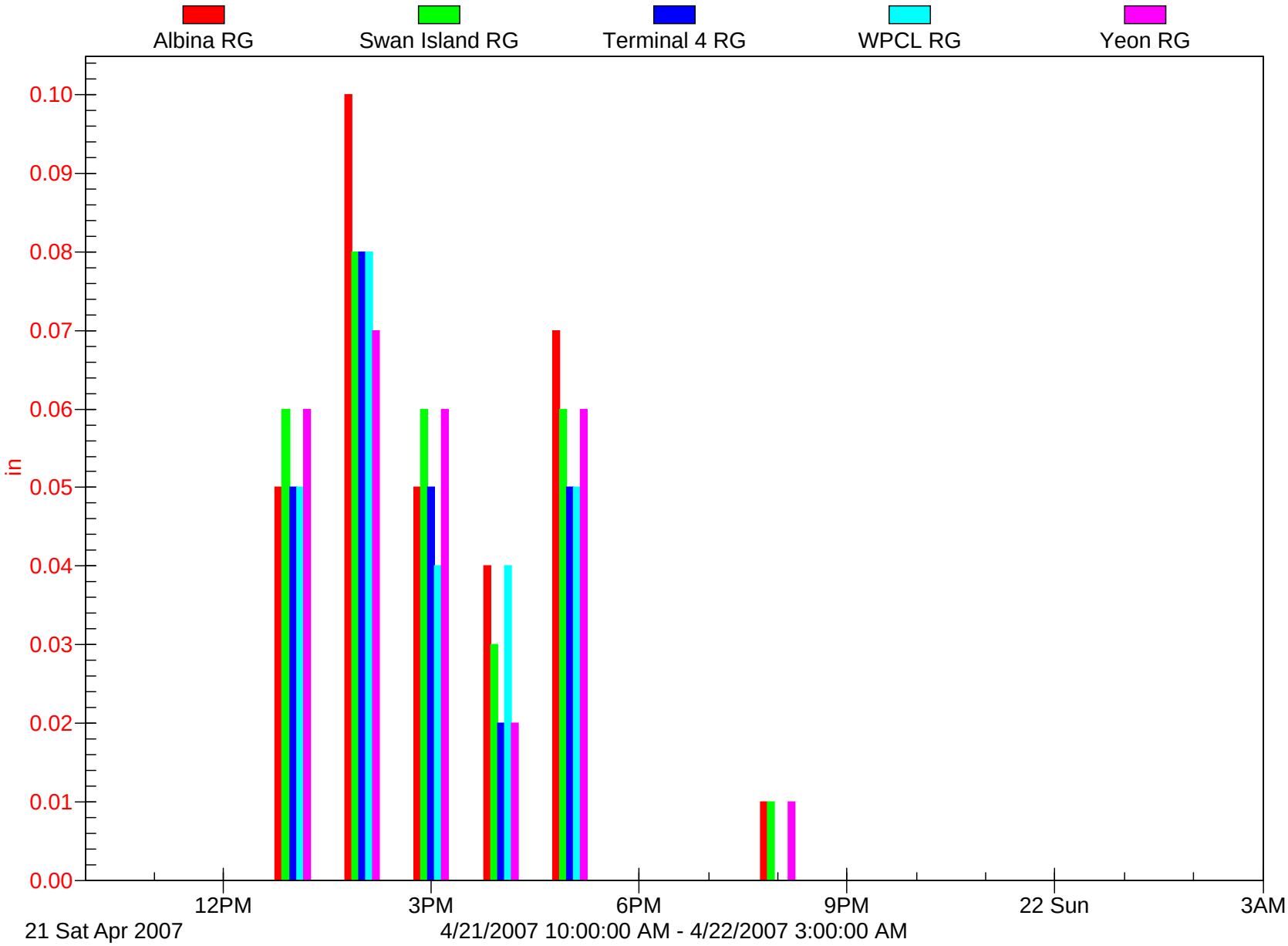


Figure 3-5 - Measured Precipitation at Rain Gages, May 1st - 2nd

May 3rd Sampling Event

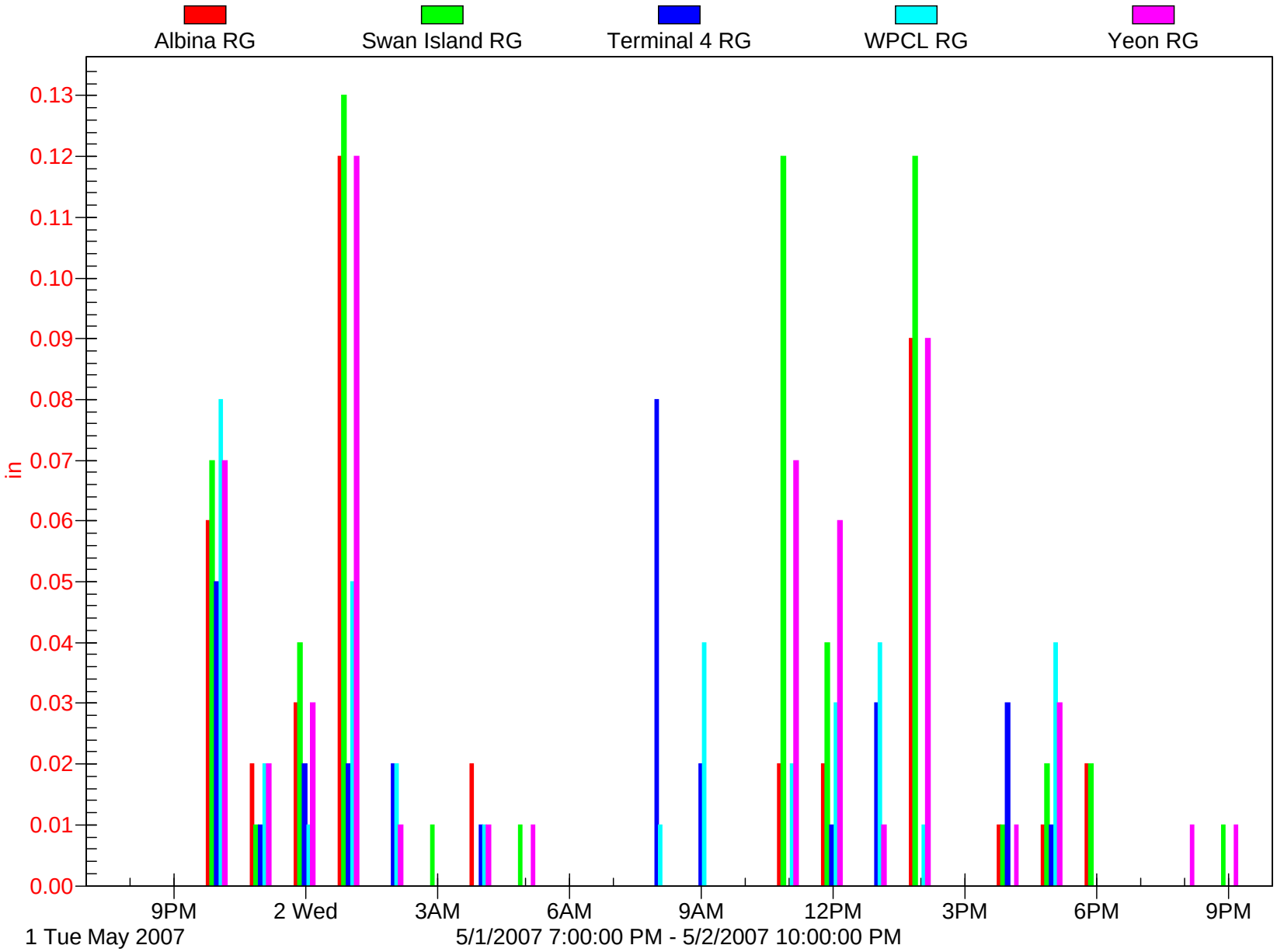


Figure 3-6 - Measured Precipitation at Rain Gages, May 20th

May 21st Grab Sample Event

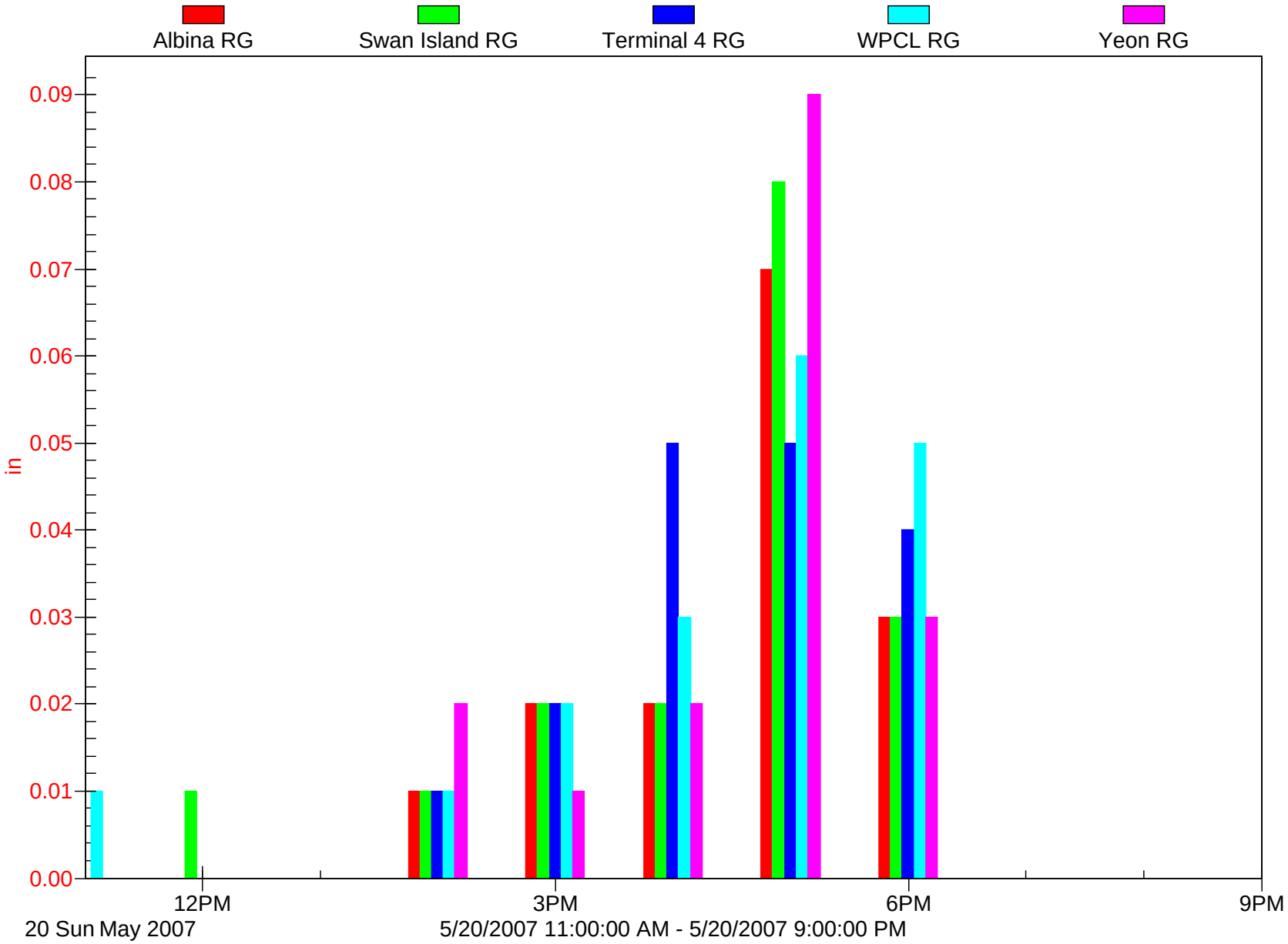


Figure 3-7 - Measured Precipitation at Rain Gages, June 5th

June 5th Grab Sample Event

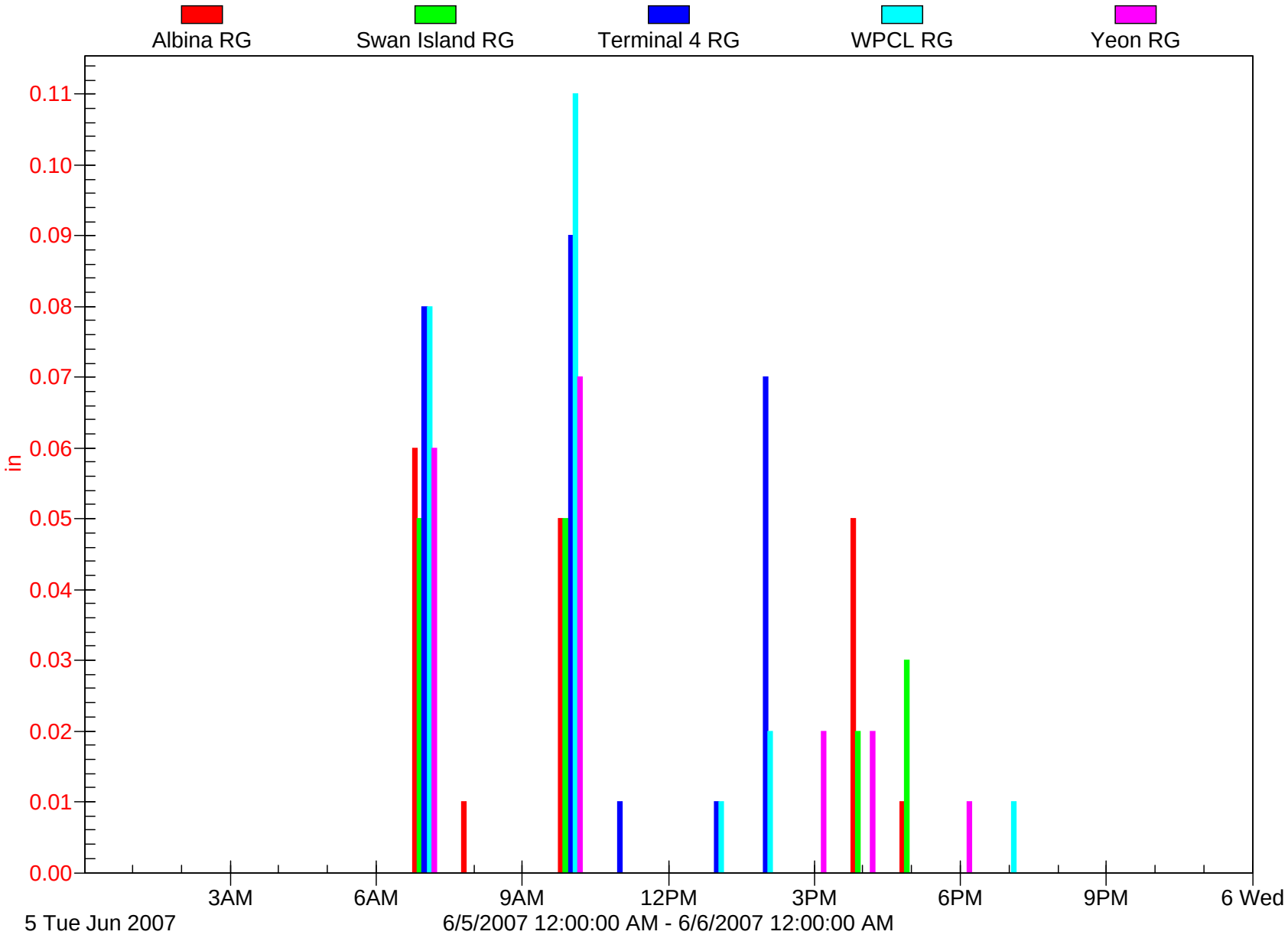
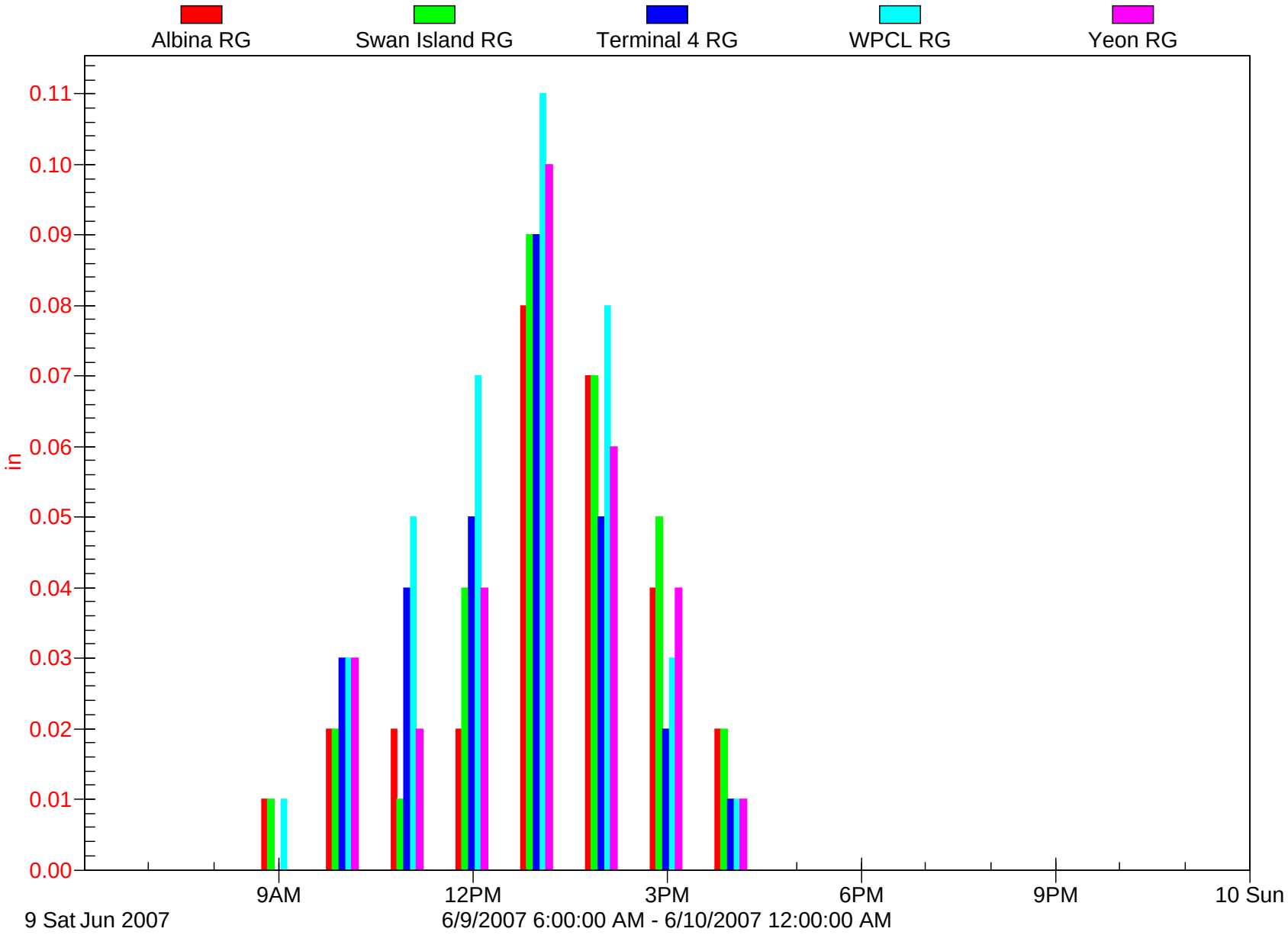
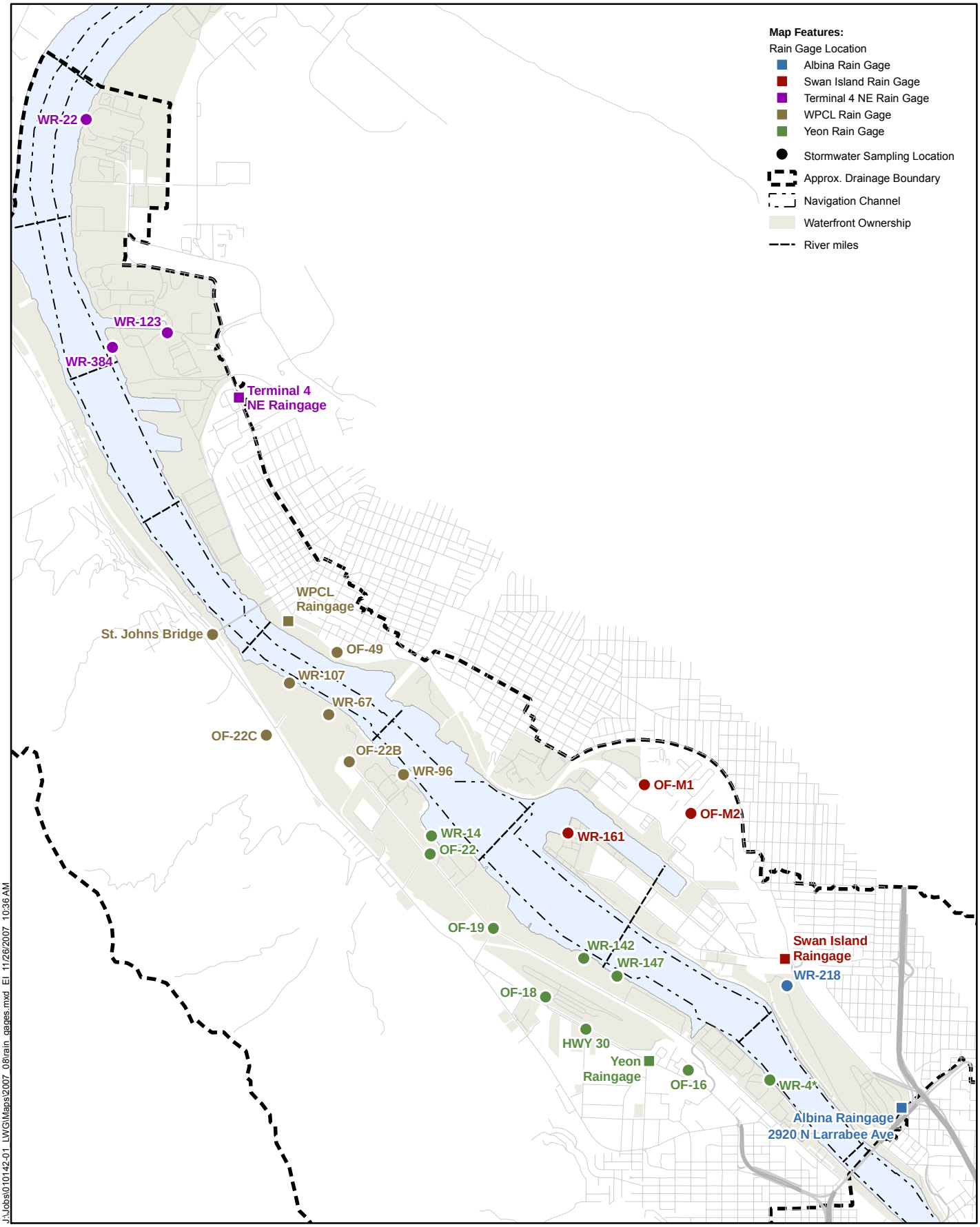


Figure 3-8 - Measured Precipitation at Rain Gages, June 9th - 10th

June 10th Sampling Event





ANCHOR ENVIRONMENTAL, L.L.C.

LWG LOWER WILLAMETTE GROUP

FEATURE SOURCES:
Land Use/Zoning, Streams, Water Bodies: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

*The outfall name designation and basin will be determined at a later date, as discussed in Section 2.0.

0 2,000 4,000 Feet

N

Figure 4-1
Rain Gages Assigned to Each Sampling Site
Round 3A Upland Stormwater Field Sampling Report
Lower Willamette Group